

# **Ergonomics International 85**

**Proceedings of the Ninth Congress  
of the  
International Ergonomics Association  
2-6 September 1985  
Bournemouth, England**

**Edited by**

**I.D. Brown, R. Goldsmith, K. Coombes and M.A. Sinclair**



*Taylor & Francis*  
*London and Philadelphia*  
1985

## CONTENTS

Preface  
Congress Organisation  
Contents

---

### POSTER PRESENTATIONS PP1

---

#### Product Design

- |   |  |    |
|---|--|----|
| 1 | <b>"Computer-aided ergonomic design of a cash payment unit (CPU) for a large retailer"</b><br>S.A. Gibson, C.J. Osborne and M.C. Bonney (UK) | 1  |
| 3 | <b>"Ergonomics assistance in building new offices and new factories"</b><br>F. Jankovsky (France)  | 4  |
| 4 | <b>"Bed design for back pain sufferers"</b><br>A.S. Nicholson, J.W. Parnell and P.R. Davis (UK)  | 7  |
| 5 | <b>"Adapting respirators for use with aerosol drug delivery"</b><br>N.M. Simonelli (USA)   | 10 |
| 6 | <b>"Statistical analysis as the basis of the methodology of machine noise ergonomical diagnostics"</b><br>M. Spychala (Poland)               | 13 |

#### Ergonomics and Education

- |    |  |    |
|----|--|----|
| 7  | <b>"Project work by final-year ergonomics students at Loughborough University"</b><br>I.A.R. Galer (UK)                                | 16 |
| 8  | <b>"Teaching of ergonomics in universities : ideas, viewpoints and many problems"</b><br>A. Honkasalo (Finland)                        | 19 |
| 10 | <b>"Function of orientation in the basic ergonomic training"</b><br>K. Launis (Finland)  | 22 |
| 11 | <b>"Microcomputers in ergonomics/human factors education : survey results"</b><br>D.B.D. Smith, M. Vercruyssen and H.W. Hendrick (USA) | 25 |
| 12 | <b>"Teaching of ergonomics at Technical Universities in Poland"</b><br>Z. Waszak (Poland)  | 28 |

- 13 **"Specific ergonomics training for ground crew employed by the Swedish Civil Aviation Administration"** 31  
C. Weibull and L. Håkansson (Sweden)

#### Ergonomics Methodology

- 14 **"An apparatus for the determination of reach envelopes"** 34  
R.S. de Andrade and L. Matias (Brazil)
- 15 **"Modification of existing anthropometric methods and instruments to meet ergonomics needs"** 37  
A. Batogowska (Poland)
- 17 **"Motografie : a method to record movements"** 40  
J.-H. Kirchner and E. Baum (FRG)
- 20 **"A new method for gauging manual work"** 43  
S. Nakayama (Japan)
- 21 **"Development of a three-dimensional system for motion study"** 46  
H. Nakayasu and M. Tsukihashi (Japan)
- 22 **"Motion study of skiing by a three-dimensional analysis system"** 49  
H. Nakayasu and M. Tsukihashi (Japan)
- 23 **"Quantitative comparison of step length, swing period and walking speed from a point of view of types and weights of manual load carrying"** 52  
Y. Uguro and T. Ohkubo (Japan)
- 24 **"Search for establishing optimum amount of motion activity at working post in seated position"** 55  
D. Sek and K. Kapaczewska (Poland)

---

#### PAPER PRESENTATIONS AND SEMINARS

---

- A1 INDUSTRIAL WORK DESIGN : GENERAL ISSUES
1. **"A comprehensive model of industrial work design"** 58  
B. Das (Canada)
2. **"Ergonomics and connecting it with planning industrial interviews"** 61  
S. Herranen (Finland)
3. **"Ergonomics problems of flexible manufacturing systems"** 64  
B. Das and A. Kusiak (Canada)
4. **"Ergonomical analysis of manufacturing processes"** 67  
L. Nawara and L. Nawara (Poland)
-

A2 HIGH TECHNOLOGY : DESIGN FOR USABILITY AND ACCEPTABILITY

1. **"Evaluating software and documentation usability"** 70  
A.S. Neal and R.M. Simons (USA)
  2. **"Certification of software usability in IBM Europe"** 73  
D. Cantwell and A. Stajano (Italy)
  3. **"User acceptability of a computer system : a case study"** 76  
F.A. Marquis and D.M. Douglas (UK)
  4. **"Effects of computerisation on journalists' work and strain"** 79  
A. Leppänen (Finland)
- 

A3 DESIGN AND USE OF HAND TOOLS

1. **"Access and force requirements on spanner usage"** 82  
S. Mason, C.A. Ferguson, D. Golding and L.A. Morris (UK)
  2. **"A review of hand tool injuries"** 85  
A. Mital and F. Aghazadeh (USA)
- 

A4 DESIGN FOR THE DISABLED

1. **"Workplace design for physically disabled"** 88  
E. Edsberg (Norway)
  2. **"Task analysis of stair-chair client transfer from ground to airplane : a case study"** 91  
S. Kumar (Canada) and D.B. Chaffin (USA)
  3. **"A computer-aided gait analysis supporting system based on knowledge engineering techniques"** 94  
K. Ito, S. Honjo, Y. Kurose, S. Takemoto and Y. Umeno (Japan)
- 

A5 "Has Ergonomics the same meaning in Europe and North America?"  
Seminar Convenor : M. de Montmollin (France)

7. G. Salvendy (USA) 97
-

A6	"Human Mental Workload" Seminar Convenor : H.W. Hendrick (USA)	
1.	<b>"Mental workload assessment : the state of the art"</b> N. Meshkati (USA)	100
2.	<b>"KBAM : a prototype knowledge-based adaptive man-machine system"</b> P.A. Hancock, M.H. Chignell and A. Loewenthal (USA)	103
3.	<b>"Effects of individual differences and perceived difficulty in coping with mental workload"</b> M.M. Robertson and H.W. Hendrick (USA)	106
4.	<b>"Systematic development of a subjective measure of workload"</b> G. Reid (USA)	109
5.	<b>"A resource theoretical task battery for workload and human performance research"</b> C.A. Shingledecker and R. Schlegel (USA)	112
6.	<b>"Considerations in the application of subjective measures of workload"</b> F.T. Eggemeier (USA)	115
<hr/>		
B1	INDUSTRIAL WORK DESIGN : SPECIFIC FACTORS	
1.	<b>"Man and technology of work on assembly lines"</b> V.J. Parezanin (Yugoslavia)	118
3.	<b>"Ergonomics in meat cutting : Design and evaluation of workstations for manual cutting"</b> R. Örtengren, M. Magnusson, P. Hagström and T. Engström (Sweden)	121
4.	<b>"Some practical aspects of personal noise dosimetry"</b> L.G. da Costa (Portugal)	124
<hr/>		
B2	HIGH TECHNOLOGY : ERGONOMICS DESIGN AIDS	
1.	<b>"The logical structure of human-computer interaction"</b> N. Moray (Canada)	127
2.	<b>"Aiding ergonomics design using an expert system"</b> N.K. Taylor, E.N. Corlett (UK), G.J. Boggs and A. Freivalds (USA)	130
4.	<b>"Task analysis in the design of nuclear power plant control rooms"</b> J. Jenkinson (UK)	133
<hr/>		

## B3 STUDIES OF LEISURE ACTIVITY

1. **"Circadian rhythms and exercise: a brief review"** 136  
T. Reilly (UK)
  3. **"A comparison of the patterns of play of squash"** 139  
M. Hughes (UK)
  4. **"Some factors affecting distance running performance"** 142  
C. McGowan, D. MacLaren, T. Reilly and P. Milroy (UK)
- 

## B4 VISUAL ASPECTS OF V.D.U. DESIGN

2. **"Positive and negative visual display screens: a comparison"** 145  
T.A.R. Berns (Sweden) and V.A. Herring (UK)
  3. **"Effect of V.D.U. colour on visual fatigue in the fovea and periphery of the visual field"** 148  
N. Osaka (Japan)
- 

## B5 SHIFTWORK AND CIRCADIAN RHYTHMS

1. **"Succession of teams and reliability of processes with shiftwork"** 151  
G. de Terssac, Y. Queinnec, D. d'Artensac and E. Delfino (France)
  3. **"Individual differences in tolerance to shift work"** 154  
R. Mooy and G. Hildebrandt (FRG)
  4. **"Masking effects on body temperature rhythms"** 157  
R. Mooy and G. Hildebrandt (FRG)
  5. **"Relationship between circadian changes in some psychophysical variables and personality types"** 160  
I. Manenica (Yugoslavia)
- 

B6 "Design of Auditory Warnings for Aircraft, Industry and Hospitals"  
Seminar Convenor : R.D. Patterson (UK)

1. **"Auditory warning systems for high-workload environments"** 163  
R.D. Patterson (UK)
2. **"Auditory warning systems on commercial transport aircraft"** 166  
A.G. Thorning and R.M. Ablett (UK)

3.	<b>"Requirements and applications of auditory warnings to military helicopters"</b>	169
	G.M. Rood, J.A. Chillery and J.B. Collister (UK)	
4.	<b>"Auditory warnings in intensive care units and operating theatres"</b>	172
	J.H. Kerr (UK)	
<hr/>		
<hr/>		
C1	INDUSTRIAL WORK DESIGN : ENVIRONMENTAL FACTORS	
1.	<b>"Classification of work stands in salt mines, based on burdensomeness and harmfulness of environmental factors"</b>	175
	J.S. Marcinkowski, Z. Niewiedzial, B. Reder and A. Zietek-Berdychowska (Poland)	
2.	<b>"The role of ergonomics in clean-room environments"</b>	178
	S.J. Czaja (USA)	
3.	<b>"Physical, technical and biological effects of acoustic adjustment designed by a research team from the Ergonomia Cooperative"</b>	181
	W. Berdychowski and A. Arentowski (Poland)	
4.	<b>"Ergonomics in the widest sense"</b>	184
	M. Jørpeland (Norway)	
<hr/>		
C2	HIGH TECHNOLOGY : RESEARCH AND DEVELOPMENT	
1.	<b>"Packaging cognitive psychology for user-interface design"</b>	187
	M.M. Gardiner and B. Christie (UK)	
2.	<b>"Accounting for individual differences : cognitive complexity as a moderator of effectiveness on a computer interactive task"</b>	190
	M. Robertson, A. Loewenthal and H.W. Hendrick (USA)	
3.	<b>"Ergonomic issues in speech recognition"</b>	193
	J.V.F. Berman (UK)	
4.	<b>"Research needs and European collaboration in human-computer interaction"</b>	196
	H.J. Bullinger and D.G. Davies (UK), K-P. Faehnrich (FRG) and B. Shackel (UK)	
<hr/>		

---

---

**C3 HEALTH AND SAFETY**

1. **"Work environment factors and health of workstand operators in salt mine industry"** 199  
J. Marcinkowski, Z. Niewiedzial, B. Reder and A. Zietek-Berdychowska (Poland)
  2. **"Physical fitness level required for the use of a self-contained breathing apparatus"** 202  
V. Louhevaara, J. Smolander and O. Korhonen (Finland)
- 
- 

**C4 MANUAL HANDLING EFFICIENCY**

1. **"Combining stress for manual materials handling tasks"** 205  
M.M. Ayoub (USA), H. Hafez (Egypt) and W. Karwowski (USA)
  2. **"Energy cost of lifting at three reaches in sagittal and lateral planes"** 208  
S. Kumar (Canada)
  3. **"An ergonomic and ergometric study of Swedish tanker truck drivers"** 211  
G. Hedberg (Sweden)
  4. **"A data base of the mechanical efficiency of the human machine during lifting and lowering tasks"** 214  
A.M. Genaidy, S.S. Asfour, M.M. Ayoub and T.M. Khalil (USA)
- 
- 

**C5 "Ergonomics in Agricultural Machine Design and Operation"**  
Seminar Convenor : L. Sjøflot (Norway)

1. **"Predicting the thermal discomfort and strain of vehicle drivers"** 217  
R.M. Stayner, D.H. O'Neill and R.T. Whyte (UK)
  2. **"Improvements of the driver's comfort and safety by various means of vibration reduction"** 220  
H. Göblich and H. Weigelt (FRG)
  3. **"Reversible tractor for better working posture and practical utilisation"** 223  
O. Breivik and L. Sjøflot (Norway)
- 
-



C6	"Design of Auditory Warnings for Aircraft, Industry and Hospitals" (Cont'd from B6) Seminar Convenor : R.D. Patterson (UK)	
1.	<b>"Specifying the sound levels for auditory warnings in noisy environments"</b> M.C. Lower and P.D. Wheeler (UK)	226
2.	<b>"Pulse generation for auditory warning systems"</b> M.J. Shailor and R.D. Patterson (UK)	229
3.	<b>"Ergonomic factors in auditory warnings"</b> J. Edworthy and R.D. Patterson (UK)	232

---

**POSTER PRESENTATIONS PP2**

---

**Ergonomics and Manufacturing Industry**

- |    |  |     |
|----|--|-----|
| 1  | <b>"Process control room design : real work analysis and operators' involvement"</b><br>M. Boel, F. Daniellou, E. Desmares and C. Teiger<br>(France)   | 235 |
| 2  | <b>"The MAT/MAP System"</b><br>A.J. Bolijn (The Netherlands)   | 238 |
| 3  | <b>"The organisation of work as a modulating factor in the effects of working schedules"</b><br>C. Chabaud and Y. Queindec (France)  | 241 |
| 4  | <b>"Development of criteria for the design and selection of hearing protectors for specific work locations"</b><br>G.J. Coleman and K.F. Sweetland (UK)  | 244 |
| 5  | <b>"The impact of combining performance standard and feedback on productivity and satisfaction"</b><br>B. Das (Canada)   | 247 |
| 6  | <b>"Ergonomics in meat-cutting: investigation of physical workload and efficiency in different systems for materials handling"</b><br>P. Hagström, T. Engström, M. Magnusson and R. Örtengren (Sweden) | 250 |
| 7  | <b>"Human supervisory performance in flexible manufacturing systems"</b><br>S.-L. Hwang and G. Salvendy (USA)  | 253 |
| 8  | <b>"Ergonomics in design of production processes"</b><br>A. Jasiak (Poland)  | 256 |
| 9  | <b>"Ergonomics of meat-cutting: investigation of factors influencing the physical workload"</b><br>M. Magnusson, R. Örtengren, P. Hagström and G. Andersson (Sweden)                                   | 259 |
| 10 | <b>"Effects of tool and operator factors on volitional torque exertion capabilities of individuals"</b><br>A. Mital (USA)  | 262 |
| 11 | <b>"An ergonomics survey of electricity generation and distribution"</b><br>A.S. Nicholson (UK)  | 265 |
| 12 | <b>"Determination of the zone of precision manipulation"</b><br>E. Nowak (Poland)  | 268 |

13	<b>"An indication of priorities and sequence of activities relating to ergonomics modernisation of manufacturing processes"</b> L.M. Pacholski (Poland)	271
14	<b>"Work-place structure"</b> R. Paluch (Poland)	274
15	<b>"Optimising the organisation of rests on assembly lines"</b> V.J. Parezanin and R.J. Parezanin (Yugoslavia)	277
16	<b>"Man and the organisation of work on assembly lines"</b> V.J. Parezanin and R. Parezanin (Yugoslavia)	280
17	<b>"Supervisory control of a flexible manufacturing system: an exploratory investigation"</b> J. Sharit and G. Salvendy (USA)	283
18	<b>"Determination of the best angle of abduction of the arm for maximum performance at the workplace"</b> R. Singh (India)	286
19	<b>"Ergonomics in the forest industry"</b> T. Sjöblom (Finland)	289
20	<b>"Machine-cycling errors with foot-switches in repetitive tasks: a workstation design simulation experiment"</b> T.R. Trump and J.R. Etherton (USA)	292
21	<b>"Ergonomic design of work-stands"</b> E.S. Tytyk (Poland)	295

---

PAPER PRESENTATIONS AND SEMINARS

---

D1	DRIVER BEHAVIOUR AND TRAFFIC SAFETY	
1.	<b>"Driver behaviour and driving style"</b> G. Labiale (France)	298
2.	<b>"Are the elderly really poor drivers?"</b> M.H. Jones and R.C. Peck (USA)	301
3.	<b>"Research on driving capability and extension of safety counselling"</b> F. Mori (Japan)	304
4.	<b>"Two actions equals no response: misinterpretations of motorcycle collision causes"</b> S.L. Johnson (USA)	307

---

## D2 STRESS AND SYSTEM DESIGN

1. **"Influence of the nature of work on evaluation of psychological load"** 310  
M. Tarniowa-Bagienska (Poland)
  2. **"Admissible time of exposure of work stand operators to environmental factors in wool industry plants"** 313  
J.S. Marcinkowski, Z. Niewiedzial and K.L. Rogalinski (Poland)
  3. **"Mental strain on VDT tasks imposed by computer system response time"** 316  
A. Komatsubara, Y. Yokomizo, S. Yamamoto and K. Noro (Japan)
  4. **"Effects of strain on VDT work"** 319  
K. Mikami and M. Kumashiro (Japan)
- 
- 

## D3 DESIGN OF OFFICE SYSTEMS

2. **"Microcomputers in the office: design process and action analysis"** 322  
L. Pinsky, F. Jeffroy, M. Lacoste and J. Theureau (France)
  3. **"Supporting computer user staff in an automated office: a case study assessment"** 325  
D.M. Douglas and F.A. Marquis (UK)
  4. **"Methods used to improve skill and comfort levels of workers using V.D.T.s"** 328  
N. Stern (USA)
- 
- 

## D4 USING ERGONOMICS KNOWLEDGE

1. **"Providing ergonomics information for industry: development of an ergonomic databank"** 331  
A. Wegner (FRG)
2. **"Some requirements for improving the industrial utility of ergonomics"** 334  
G.C. Simpson (UK)
3. **"Design ergonomics: art, science or technology?"** 337  
S.C. Brown (UK)

4. **"Ergonomics and management in the oil industry"** 340  
A. Howie (Australia)
5. **"Ergonomic diagnosis of machine designs"** 343  
J. Slowikowski (Poland)

- D5 "Paced Work"  
Seminar Convenor : P.V. Bulat (Yugoslavia)
1. **"Autonomous self-managing workgroups: model A as the result of humanisation of machine-paced work"** 346  
V.P. Bulat, D. Marcovic, J. Danon, G. Janezic, B. Fatovic, V.J. Parezanin, R.J. Parezanin and P.J. Vukasovic (Yugoslavia)
2. **"Job stress before and after the redesign of semipaced production lines"** 349  
S. Klemola, I. Kuorinka, P. Seppälä, P. Koskinen and R. Siikaranta (Finland)
3. **"Methodological issues in research on machine-paced work"** 352  
G. Salvendy (USA)
4. **"Some problems in the measurement of paced work"** 355  
M. Culic (Yugoslavia)

- D6 "Participatory Ergonomics"  
Seminar Convenor : R.G. Sell (UK)
1. **"It takes both experts and job holders to design jobs"** 358  
R.G. Sell (UK)
2. **"Need for participative approach of ergonomics and company-wide ergonomic activities"** 361  
K. Noro (Japan)
3. **"Participative ergonomics: its utility, its appeal, and its necessity"** 364  
A.S. Imada (USA)
4. **"Participation as a design tool"** 367  
L.K. Martensson (Sweden)
5. **"Participatory approach in applying ergonomics for workplace improvements in developing countries"** 370  
K. Kogi (Thailand)

6. **"Increasing community awareness of ergonomics: a low-key educational approach"** 373  
T.J. Fischhof (Australia)
- 

---

E1 OCCUPATIONAL STRESS AND JOB SATISFACTION

1. **"Occupational stress, job satisfaction and mental health of industrial managers"** 376  
A. Khaleque (Bangladesh)
2. **"Job stress and satisfaction in self-paced and non-paced work"** 379  
M. Rahman (Bangladesh)
3. **"Psychological investigation on job satisfaction dynamics"** 382  
A.N. Iwanowa and M.P. Radoslavova (Bulgaria)
4. **"Adult education and workers investigation: an ergonomic survey by Leeds busworkers"** 385  
K. Forrester (UK)
5. **"Toward a model of stressor interactions"** 388  
P.A. Hancock (USA)
- 

E2 OFFICE WORKSTATION DESIGN

1. **"Ergonomics and visual display units"** 391  
S.-E. Hermansen (Denmark)
2. **"Adjustable VDT workstations as experienced by infrequent users"** 394  
M. Launis and J. Lehtelä (Finland)
3. **"Typist performance on electronic keyboards with and without electromechanical features"** 397  
A.S. Neal and W.H. Emmons (USA)
4. **"Investigation of the lumbar flexion of office workers: especially in relation to furniture height and seat angle"** 400  
A.C. Mandal (Denmark)
5. **"Libraries : a fertile ground for ergonomics"** 403  
S.M. Grey and J.R. Wilson (UK)
-

E3 ERGONOMICS METHODOLOGY

- 1. **"Remedial human factors engineering associated with power plant control rooms"** 406  
J.L. Seminara and S.O. Parsons (USA)
- 2. **"Why do ergonomists need fuzzy sets?"** 409  
W. Karwowski (USA)
- 3. **"An evaluation procedure for selecting database systems according to usability and functionality criteria"** 412  
T.H. Penniall (UK)
- 4. **"Shrinkage: a measure for the evaluation of ergonomic designs"** 415  
J.A.E. Eklund (Sweden) and E.N. Corlett (UK)

E4 MEASUREMENT, ASSESSMENT AND MANAGEMENT OF POSTURAL STRESS

- 1. **"Visual, ocular, neck and postural stress: their relationship, assessment and management"** 418  
C.H. Bedwell (UK)
- 2. **"Assessment and measurement of ocular and neck stress by EMG"** 421  
I. Lie and R. Watten (Norway)
- 3. **"Identification of ergonomics problems by means of questionnaires for musculoskeletal troubles"** 424  
B. Jonsson and B. Ydreborg (Sweden)
- 4. **"Automatic three-dimensional measurement of human movements: technical solution and data analysis for cockpit design"** 427  
K.-P. Holzhausen (FRG)

E5 "New Technology and Road Safety"  
Seminar Convenor : Y.I. Noy (Canada)

- 1. **"New technology and road safety: the role of ergonomics"** 430  
Y.I. Noy (Canada)
- 2. **"The potential use of optical videodiscs in automotive navigational systems - a prototype system"** 433  
T. Held (USA)
- 3. **"Driver alerting devices: new technology, old problems"** 436  
D.M. Zaidel (Israel)
- 4. **"In-vehicle information systems: the role of Ergonomics"** 439  
M. Galer (UK)

E6	"Ergonomics for Maintenance Activities" Seminar Convenor : S. Deivanayagam (USA)	
1.	<b>"Computer-aided design models to support ergonomics"</b> J.W. McDaniel and W.B. Askrem (USA)	442
2.	<b>"Job demands in some maintenance operations"</b> M.M. Ayoub, J.L. Smith, J.W. McDaniel and J.L. Selan (USA)	445
3.	<b>"Maintainability ergonomics: human torque strength study"</b> S. Deivanayagam (USA)	448
4.	<b>"Performance differences between preferred and non-preferred hand when using various tools"</b> S. Konz and M. Warraich (USA)	451

---

## F1 POSTURAL WORKSTRESS

1.	<b>"Repetition Strain Injury and ergonomics: an Australian experience"</b> T.G. Shinnick (Australia)	454
2.	<b>"Keyboards designed to fit hands and reduce postural stress"</b> S.W. Hobday (UK)	457
3.	<b>"An ergonomic study of professional coastal fishing"</b> M. Törner, R. Karlsson and R. Kadefors (Sweden)	460
4.	<b>"Working postures and associated stress in a nursing population"</b> D. Baty, D.A. Stubbs, P.W. Buckle, M.P. Hudson and P.M. Rivers (UK)	463
5.	<b>"Ergonomics contributions to the rehabilitation of low back pain"</b> T.M. Khalil, S.S. Asfour, R. Steele and H.L. Rosomoff (USA)	466

---

## F2 DESIGN AND USE OF SOFTWARE

1.	<b>"Impact of the depth of menu hierarchy on performance effectiveness in a supervisory task"</b> P. Seppälä (Finland) and G. Salvendy (USA)	469
2.	<b>"Programming expertise and program understanding"</b> F. Detienne (France)	472



3. **"Hierarchical planification in programming"** 475  
A. Morais (France)
4. **"Activity representation and planning in office work"** 478  
S. Sebillotte (France)

---



---

#### F3 TRANSFER EFFECTS OF HUMAN-COMPUTER INTERACTION

1. **"Interactive videodisc games and training in land navigation"** 481  
C.M. Knerr, R.J. Seidel and H. Wagner (USA)
2. **"The effects of playing video games on performance on tests of tracking ability"** 484  
D. Bartram, M. Poots, S. Hayes and R. Bayliss (UK)
3. **"The teaching of medical decision-making with a two-person-game operation simulator"** 487  
S. Trispel, H. Klocke and G. Rau (FRG)
4. **"The social and psychological effects of excessive computer usage"** 490  
M.A. Shotton (UK)
5. **"Signal detection theory in man-computer interaction"** 493  
K. Baer and F. Nachreiner (FRG)

---



---

#### F4 WORKLOAD MEASUREMENT IN MANUFACTURING INDUSTRY

1. **"Problems of ergonomic analysis of strenuousness of work in industrial practice"** 496  
W.J. Grzybowski (Poland)
  2. **"An ergonomics methodology developed for applied field research: a case study"** 499  
K. Vanwonderghem (Belgium)
  3. **"Computer-aided assessment of workload using predetermined motion-time systems"** 502  
F.M. Kühn and W. Laurig (FRG)
  4. **"Digital and graphic displays for process control"** 505  
B.G. Coury and C.M. Pietras (USA)
- 
-

F5	"New Technology and Road Safety" (Cont'd from E5) Seminar Convenor : Y.I. Noy (Canada)	
1.	<b>"Driver eye scanning, the information acquisition process and sophisticated in-vehicle information displays and controls"</b> H.T. Zwahlen (USA)	508
2.	<b>"Research methodology for ergonomics problems involving the application of new technology in vehicle design"</b> R.W. Allen (USA)	511
3.	<b>"Methodology and results for driver evaluation of electronic automotive displays"</b> H.L. Snyder (USA)	514
4.	<b>"Possible safety consequences of new technology"</b> J. Wachtel (USA)	517
<hr/>		
F6	"Macroergonomics in Organisations" Seminar Convenor : S.M. Dray (USA)	
1.	<b>"Macroergonomics in organisations: an introduction"</b> S.M. Dray (USA)	520
2.	<b>"Escape clauses: a solution for the problem of bounded technology in an unbounded world"</b> D.A. Henderson (USA)	523
3.	<b>"Macroergonomics in organisations"</b> J.C. Gower (UK)	526
4.	<b>"Ergonomic considerations to the sociotechnical design of information technology systems"</b> K.D. Eason (UK)	529
<hr/>		
<hr/>		

---

 POSTER PRESENTATIONS PP3
 

---

Effects of Stress

- |    |  |     |
|----|--|-----|
| 2  | <b>"Reduction of vibration stress with hand-operated mowing machines"</b><br>H.-J. Bullinger and W.F. Muntzinger (FRG)   | 532 |
| 3  | <b>"A portable simulator of altitude stress"</b><br>N. Clucus, T. Reilly and P. McLean (UK)  | 535 |
| 4  | <b>"Influence of socio-professional conditions on blood-pressure levels: epidemiological study of 7700 subjects in the Paris district"</b><br>C. Fouriaud, M.C. Jacquinet-Salord, P. Dequoulet, T. Lang, F. Aime, J. Laprugne, J. Main, J. Oeconomos, J. Phalente and A. Prades (France) | 538 |
| 5  | <b>"Thermal comfort for residing in tropical humid conditions"</b><br>F. Grivel, J.C. Deval and X. Berger (France)   | 541 |
| 6  | <b>Effects of office climate on sedentary performance"</b><br>H.A. Hafez and M.Y. Beshir (Egypt)   | 544 |
| 7  | <b>"Transient myopia and individual dark focus after working at visual displays"</b><br>W. Jaschinski-Kruza (FRG)  | 547 |
| 8  | <b>"Lifting and carrying in geriatric care: a comparison between differences in workspace layout, work organisation, and use of modern equipment"</b><br>A. Kilbom, A.-S. Ljungberg and G. Hägg (Sweden)   | 550 |
| 9  | <b>"Low capacity of the shoulder muscles as a risk factor for occupational cervicobrachial disorders"</b><br>A. Kilbom and J. Persson (Sweden)   | 553 |
| 10 | <b>"Comparison of the relative effectiveness of ergonomic design and physical exercise"</b><br>K.S. Lee and L. Humphrey (USA)  | 556 |
| 11 | <b>"Effects of low-frequency sound on the human body"</b><br>N. Machida, Y. Yoshida and S. Itoh (Japan)  | 559 |
| 12 | <b>"Some age-related changes in visual scanning in tasks with high perceptual demand"</b><br>J.C. Marquie (France)   | 562 |
| 13 | <b>"Workrate allowances in industrial heat stress criteria: a potential source of error"</b><br>L.A. Morris, R.A. Graveling and G.C. Simpson (UK)  | 565 |
| 14 | <b>"Personal cooling garments for the alleviation of thermal stress in mining"</b><br>A.G.McK. Nicholl, R.A. Graveling and R. Wildblood (UK)   | 568 |

17	<b>"Heart-rate, work-load and perceived exertion in men and women during incremental and sustained exercise"</b> P.K. Pedersen and K. Froberg (Denmark)	571
18	<b>"Combined stress by muscular work and heat: analysis of field studies"</b> H. Peters (FRG)	574
19	<b>"Comparison of indices for assessing heat stress"</b> J.D. Ramsey and M.Y. Beshir (USA)	577
20	<b>"Electromyographic analysis of upper extremity postures in a VDT data entry task"</b> R.R. Rosa and V.P. Anderson (USA)	580
21	<b>"Relationship between eyestrain and mental strain of industrial workers"</b> M. Saito and T. Hasegawa (Japan)	583
22	<b>"An objective measurement of accommodation after effect in terms of display colour of VDT"</b> T. Takeda, Y. Fukui, T. Iida and K. Karasuyama (Japan)	586
23	<b>"A qualitative evaluation method of the heat stress for rescuers, trained in heavy climatic conditions"</b> K. Vanwonderghem (Belgium)	589
24	<b>"Use of serial choice reactions to assess the effects of stressors: a psychometric tool"</b> M. Vercruyssen (USA)	592
25	<b>"Laboratory validation of a model for predicting human response to thermal environments"</b> I. Watkins and K.C. Parsons (UK)	595
26	<b>"Effect of leg activity on foot swelling, lower leg/foot temperatures and discomfort during prolonged sedentary office work"</b> J. Winkel and K. Jorgensen (Sweden)	598
27	<b>"Studies on the effects of low frequency vibration to the human body: physiological and psychological effects of low frequency vertical vibration on females"</b> Y. Yoshida, N. Machida and S. Itoh (Japan)	601

---

 PAPER PRESENTATIONS AND SEMINARS
 

---

## 61 FITNESS FOR SPECIFIC TASKS

1.	<b>"Job content and ergonomic questionnaires for assessment of work strain among engineering industry personnel"</b> J. Kirjonen (Finland)	604
----	---	-----

2. **"Paviour, an unhealthy trade?"** 607  
E.A.P. Koningsveld (Netherlands)
3. **The strain on the shoulder and neck muscles during letter sorting** 610  
K. Jørgensen, N. Fallentin and B. Sidenius (Denmark)
5. **Job demands and assessment of physical work capacity in policemen's occupational health service** 613  
J. Smolander, V. Louhevaara, C.-H. Nygard, O. Korhonen and M. Ylikoski (Finland)

G2 CLASSIFICATION AND CAUSES OF UNRELIABLE HUMAN BEHAVIOUR

1. **"Development of a taxonomy for unsafe worker behaviours"** 616  
J.D. Ramsey, C.L. Burford and M.Y. Beshir (USA)
3. **"Differential automatization processes as a function of the type of stimuli"** 619  
S. Bagnara, A. Rizzo, M. Visciola and D. Salmaso (Italy)
4. **"Reliability in a partially automatised workshop: the part played by the operators"** 622  
M. Lenay, C. Davillerd and G. Krawsky (France)

G3 SYSTEM RELIABILITY IN MANUFACTURING INDUSTRY

2. **"Ergonomic criteria for estimating the reliability of industrial production processes"** 625  
M. Gorska-Formaniak (Poland)
3. **"From accident prevention to applied ergonomics: the collaboration between an insurance company, covering work accidents, and an ergonomics research institute"** 628  
K. Vanwonderghem (Belgium)
4. **"Ergonomics problems associated with vehicle maintenance in motor transport workshops"** 631  
J.E. Ridd, G.C. David, A.S. Nicholson, D. Baty, P.W. Buckle and D.A. Stubbs (UK)

## G4 INFORMATION DISPLAYS IN TRANSPORT SYSTEMS

1. **"Preliminaries to an examination of the effectiveness of ships navigation lights"** 634  
R. Maciel and J. Spencer (UK)
2. **"Analysing way-finding problems in new outpatient departments"** 637  
P.J. Venemans (Netherlands)
3. **"Thoughts on task achievement strategies with information and control redundancy"** 640  
G. Santucci, R. Amalberti, C. Valot and J.P. Menu (France)

## G5 PRODUCT DESIGN FOR TRANSPORTATION

1. **"Anthropotechnical checklist for the design of engine rooms aboard ships, based on ergonomic standard elements"** 643  
H.B. Müller-Schwenn (FRG)
2. **"Computer simulation of reach zones for the agricultural driver"** 646  
C.J. Reid, S.A. Gibson, M.C. Bonney and D. Bottoms (UK)
3. **"Designs of selector levers for automatic transmission"** 649  
T. Nagano (Japan)
4. **"A comparative evaluation of three supermarket shopping carts"** 652  
L.E. King (USA)

## G6 "International Standardisation in the Field of Ergonomics"

Seminar Convenor : H. Jüptner (FRG)

1. **"International standardisation in the field of ergonomics"** 655  
H. Jüptner (FRG)
3. **"What is so new about 'ergonomics' standards?"** 658  
P. Branton (UK)
6. **"Information about I.S.O."** 661  
H.J. Sälzer (FRG)

---

---

**H1 FITNESS FOR WORK: INDIVIDUAL CHARACTERISTICS**

1. **"Impact of changes in physical fitness on the effectiveness of decision making"** 664  
S. Suominen and G. Salvendy (USA)
  2. **"The degree of professional suitability of the operators of artistic handicraft stands"** 667  
A. Zietek-Berdychowska (Poland)
  3. **"The effect of lifting light loads on the shape of healthy and scoliotic female spines"** 670  
C.M. Gross (USA)
  4. **"On employment of the disabled as office personnel"** 673  
R. Junker (FRG)
- 
- 

**H2 TASK-SPECIFIC ASPECTS OF HUMAN RELIABILITY**

1. **"Man's liability to illness and accidents in industrial production systems"** 676  
J.S. Marcinkowski (Poland)
  2. **"Human reliability in aviation"** 679  
J. Wheale (UK)
- 
- 

**H3 WORKING TOWARDS STANDARDS**

1. **"A standard for ergostandards?"** 682  
H.C.W. Stockbridge (UK)
  2. **"Human factors guidelines for the design of computer-based systems"** 685  
A. Gardner, T. Mayfield, M. Maguire and J. McKenzie (UK)
  3. **"Developing human factors standards for dialogue design: a case study"** 688  
B.C. Taylor and S.D.P. Harker (UK)
  4. **"Implementing new work technologies: some implications for human resource management"** 691  
F. Fallik (USA)
- 
-

## H4 PSYCHOPHYSIOLOGICAL ASPECTS OF COGNITIVE STRESS

1. **"Psychophysiological investigations of a VDU repetitive task"** 694  
R. Floru and F. Cail (France)
  2. **"Effects of hypoxia on visual and cognitive performance"** 697  
J.L. Kobrick (USA)
  3. **"Effects of carbohydrate feeding on mental functions during sustained physical work"** 700  
T. Reilly and W. Lewis (UK)
  4. **"Additive factors method in stressor research: effects of carbon dioxide breathing on stages of information processing"** 703  
M. Verduyssen (USA)
- 
- 

H5 "Ergonomics and Trades Union Action"  
Seminar Convenor: S. Bagnara (Italy)

1. **"American unions struggle with technology"** 706  
M. Maccoby and R. Straw (USA)
- 
- 

H6 "Modelling Human Reliability"  
Seminar Convenor: D.E. Embrey (UK)

1. **"Models of the human operator in relation to human reliability"** 709  
N. Moray (Canada)
  2. **"A methodology for assessing communication errors in high-risk systems"** 712  
L.J. Bellamy and B.I. Kirwan (UK)
  3. **"An interactive technique for modelling and assessing the operator's mental model in complex man-machine systems"** 715  
D.E. Embrey (UK)
- 
- 

## J1 MEASURING FITNESS FOR WORK

1. **"Pre-employment screening procedures for effects of stress"** 718  
L.E. Allen (USA)



- |    |  |     |
|----|--|-----|
| 2. | <b>"Evaluation of strength testing methods for employee screening"</b><br>J.L. Smith and C.C. Plott (USA)            | 721 |
| 3. | <b>"Additivity of static and dynamic strength of males"</b><br>W. Karwowski, A. Mital and J.W. Yates (USA)           | 724 |
| 4. | <b>"A procedure for estimating physical work capacity"</b><br>T.J. Gallwey and S. Foley (Ireland)                    | 727 |
| 5. | <b>"Measurement and evaluation of vocational ability of older workers"</b><br>Y. Yokomizo and A. Komatsubara (Japan) | 730 |
- 

#### J2 STANDARDISATION: SPECIFIC DEVELOPMENTS

- |    |  |     |
|----|--|-----|
| 1. | <b>"Ergonomic input to standards development for tunnelling machines"</b><br>W.L. Chan and A.J. Pethick (UK)   | 733 |
| 2. | <b>"Present standardisation of test procedures for ergonomic testing of tracked and wheeled vehicles of the Federal Armed Forces, Germany"</b><br>D. Wiegand (FRG) | 736 |
| 3. | <b>"Behavioural research on the maximum allowable concentration of carbon dioxide in self-contained breathing systems"</b><br>M. Vercruyssen (USA)                 | 739 |
| 4. | <b>"The problem of safe loading"</b><br>S. Gracovetsky (Canada)  | 742 |
- 

#### J3 HEAT, NOISE AND MOTOR-LOAD STRESS

- |    |   |     |
|----|---|-----|
| 1. | <b>"The relationship between stress and attention: evidence from performance under thermal extremes"</b><br>P.A. Hancock (USA)  | 745 |
| 2. | <b>"Indicators of stress in military life support systems"</b><br>L.E. Symington and H.L. Meiselman (USA)   | 748 |
| 3. | <b>"An attentional view of narrowing: the effect of noise and signal bias on discrimination in the peripheral visual field"</b><br>G.R. Dirkin and P.A. Hancock (USA) | 751 |
| 4. | <b>"Effect of noise, vehicular control configuration and motor load on human performance"</b><br>S.A.H. Rizvi, J.L. Batra and N.K. Sharma (India)                     | 754 |

5. **"Effect of sex, vehicular control configuration and motor load on human performance"** 757  
S.A.H. Rizvi, J.L. Batra and N.K. Sharma (India)

J4 COMMUNICATION AND CONTROL IN TRANSPORT SYSTEMS

1. **"The ergonomics of the driver/passenger interface in the cabs of one-person-operated London buses"** 760  
V.M. Bellotti and R.R. Birnbaum (UK)
2. **"Analyse des prises d'informations dans un poste informatise de regulation de trafic de bus"** 763  
C. Marine (France)
3. **"Analyse des prises de decision de surveillance sur ecran dans une tache de regulation de trafic de bus urbain"** 766  
M. Cellier (France)
4. **"Analysis of communications during a flight task in a transport aircraft"** 769  
C. Navarro (France)

J5 "Quantifying Human Reliability"  
Seminar Convenor: D.E. Embrey (UK)

1. **"Human reliability as an ergonomic tool: methodological review and examination of psychological antecedents"** 772  
D. Meister (USA)
2. **Stochastic computer simulation approach to human performance reliability determination: background and application examples"** 775  
A.I. Siegel and J.J. Wolf (USA)
3. **"SLIM-MAUD: a computer based technique for human reliability assessment"** 778  
D.E. Embrey (UK)

J6 "Measurement and Management of Industrial Workload"  
Seminar Convenors: Scientific Research Centre for Development of Ergonomic Systems (Poland)

1. **"The problem of practical correction in conditions of limited investment capabilities of enterprises"** 781  
P. Bierla (Poland)

- |    |   |     |
|----|---|-----|
| 2. | <b>"The method of quantitative estimation of motor activity"</b><br>M. Zajaczkowski and P. Bierla (Poland)                      | 784 |
| 3. | <b>"The problem of aggregation in the complex estimation of workload arduousness"</b><br>P. Bierla and M. Zajaczkowski (Poland) | 787 |
| 4. | <b>"An assessment of the impact of energy expenditure upon sensations of work arduousness"</b><br>W. Pyrzowski (Poland)         | 790 |
| 5. | <b>"The actual production rate as one of the criteria of work arduousness"</b><br>M. Zajaczkowski (Poland)                      | 793 |
- 
-

---

 POSTER PRESENTATIONS PP4
 

---

Ergonomics and Transport

- |    |   |     |
|----|---|-----|
| 1  | <b>"Computerisation of workstations: contribution of the ethological approach through a case study"</b><br>N. Delvolve (France)   | 796 |
| 2  | <b>"The importance of anthropometric relationships in vehicle packaging"</b><br>C.M. Haslegrave (UK)  | 799 |
| 4  | <b>"Low back pain among container tractor drivers in harbour cargo transportation"</b><br>Y. Kondo, H. Mito, I. Kadowaki, N. Yamashita and M. Hosokawa (Japan)                      | 802 |
| 5  | <b>"Researches on driver behaviour"</b><br>S. Milosevic (Yugoslavia)  | 805 |
| 6  | <b>"Visibility studies under tunnel illumination"</b><br>H. Mito and T. Shimizu (Japan)   | 808 |
| 7  | <b>"Combine harvesters cab design: a case study"</b><br>R.M. Naveiro and E.N. Medeiros (Brazil)   | 811 |
| 8  | <b>"Development of an ergonomically designed monorail conveyer cab (MRCC)"</b><br>H. Schnauber and W. Sander (FRG)  | 814 |
| 9  | <b>"The effectiveness of stationary versus moving police vehicles on compliance with speed limits"</b><br>D. Shinar and J. Stiebel (Israel)   | 817 |
| 10 | <b>"Checklist for signposting"</b><br>P.J. Venemans (The Netherlands)   | 820 |
| 11 | <b>"Investigations into car seat comfort testing: three different environments and the differences between driver and passenger responses"</b><br>P. Wilkinson and J.M. Porter (UK) | 823 |

Ergonomics and High Technology

- |    |  |     |
|----|--|-----|
| 12 | <b>"Current ergonomic research and development at Lockheed"</b><br>S.O. Parsons and J.L. Seminara                                | 826 |
| 14 | <b>"Active retouch of light intensity relations: an ergonomic component in human visual perception"</b><br>J. Weckroth (Finland) | 829 |
| 16 | <b>"Polar coordinate process control displays"</b><br>R.E. Schlegel, T.H. Brace and J.B. Peacock (USA)                           | 832 |

- 17 **"Detection of on-coming off-normals in VDU trend presentation"** 835  
P. van Schaik and J.E. Rijnsdorp (The Netherlands)

---

PAPER PRESENTATIONS AND SEMINARS

---

K1 CHANGING NEEDS FOR JOBS AND SKILLS

1. **"Job diversity: a liberating alternative?"** 838  
P.R. Michael and M. Ballantine (UK)
2. **"Training the non-specialist users of computer-based systems"** 841  
R.B. Stammers (UK)
3. **"Cognitive and affective factors related to computer programming performance"** 844  
R. Koubek, W.K. LeBold and G. Salvendy (USA)
4. **"Ergonomics aspects in an automated factory"** 847  
M.A. Sinclair (UK)

---

K2 ERGONOMICS IN DEVELOPING COUNTRIES

1. **"Future directions in ergonomics"** 850  
J. Spencer (UK)
2. **"Exchange of ergonomics information on industrially developing countries"** 853  
H. Shahnavaz and L. Gilroy (Sweden)
3. **"The ergonomist advising in a developing country"** 856  
J. Wood (UK)
4. **"Organisation of work in traditional agriculture in India"** 859  
P.K. Nag (India)

---

K3 EFFECTS OF REPETITIVE LIFTING

1. **"E.M.G., spinal motion and load acceleration during repetitive lifting: a preliminary investigation"** 862  
T.M. Cook (USA)
2. **"The relationship between frequency of lift and lifting capacity"** 865  
S.S. Asfour, A.M. Genaidy and T.M. Khalil (USA)

3. **"Modelling of the human kinetics during repetitive lifting"** 868  
A.M. Genaidy, S.S. Asfour, and T.M. Khalil (USA)
4. **"Modelling lifting capabilities of industrial workers for regular and extended work-shifts"** 871  
A. Mital (USA)

## K4 TRAFFIC NUISANCE

1. **"Assessment of the visual intrusion of trucks in the road environment"** 874  
M. Fowkes, A. Rew and I. Wood (UK)

K5 "Increasing Participatory Ergonomics and Organisational Function: a Field Experiment"  
Seminar Convenor: H.W. Hendrick (USA)

1. **"Increasing participatory ergonomics and organisational functioning through supervisory skill training"** 877  
O. Brown (USA)
2. **"Effects of management commitment and reinforcement on a supervisory skills training programme"** 880  
M.D. Van Slyke (USA)
3. **"Increasing participatory ergonomics and organisational functioning through a quality circle programme"** 883  
H.W. Hendrick (USA)
4. **"Results of supervisory skills training: preliminary analysis of a systems intervention"** 886  
A.S. Imada (USA)

K6 "Epidemiological Studies of Cumulative Trauma Disorders: State of the Art"  
Seminar Convenor: L.J. Fine (USA)

1. **"Analysis and control of upper extremity posture"** 889  
T. Armstrong, B. Buchholz, R. Radwin, S. Tobey and C. Woolley (USA)
2. **"Cumulative trauma disorders of the hand and wrist in industry"** 892  
B. Silverstein, L. Fine, T. Armstrong, B. Joseph, B. Buchholz and M. Robertson (USA)

- |    |   |     |
|----|---|-----|
| 3. | <b>"Postural characteristics of jobs associated with an elevated risk of rotor cuff tendonitis"</b><br>L. Fine, B. Silverstein, T. Armstrong, B. Joseph and B. Buchholz (USA) | 895 |
| 4. | <b>"An ergonomic control programme and its evaluation"</b><br>B.S. Joseph, J.K. Liker and T. Armstrong (USA)  | 898 |
- 

## L1 LIFTING AND LOWERING TASKS

- |    |   |     |
|----|---|-----|
| 1. | <b>"E.M.G. analysis: muscle load and fatigue in manual work"</b><br>C. Almström, R. Kadefors and K. Severinsson (Sweden)                                | 901 |
| 2. | <b>"Organisation of industrial loading tasks based upon a prediction of workers' strain"</b><br>W. Laurig, M. Gencoglu, F.M. Kühn and A. Luttmann (FRG) | 904 |
| 3. | <b>"Physiological responses to manual lifting in a hot environment"</b><br>H.A. Hafez and M.M. Ayoub (USA)  | 907 |
| 4. | <b>"Lift with your legs, not with your back: a realistic directive?"</b><br>R.A. Graveling, G.C. Simpson and M.T. Sims (UK)                             | 910 |
- 

## L2 ERGONOMICS OF THE SCHOOL

- |    |   |     |
|----|---|-----|
| 1. | <b>"Ergonomic criteria for designing didactic environments"</b><br>W. Prussak (Poland)                              | 913 |
| 2. | <b>"Microcomputer learning environments"</b><br>A.R.J. Yeaman (USA)   | 916 |
| 3. | <b>"Hazard analysis of gymnastic apparatuses"</b><br>J.-H. Kirchner, H.-M. Henken, M. Kleim and J. Rappsilber (FRG) | 919 |
| 4. | <b>"User interfaces for computer assisted learning"</b><br>F.J.J. van Bussel (The Netherlands)                      | 922 |
-

L3	ERGONOMICS OF THE HOME	
1.	<b>"Safety of domestic products: an ergonomics approach"</b> E.J. Fulton (UK)	925
2.	<b>"Quantitative assessment of the dimensions of stairs"</b> H. Nagata (Japan)	928
3.	<b>"Minimum width of domestic stairs provided with handrails"</b> S. Kose and H. Uno (Japan)	931
4.	<b>"An ergonomic evaluation of workload in selected meal preparation tasks at two different heights of kitchen platform"</b> M. Varghese, N. Atreya and P.N. Saha (India)	934
<hr/>		
L4	"Electronic Mail in Telecommunications" Seminar Convenor: D.M. Thomson (UK)	
1.	<b>"Mailbox systems: current status, future potential"</b> P.A. Wilson (UK)	937
2.	<b>"What's wrong with staying in bed anyway? Enhancing electronic communication for people"</b> C.J. Marshall (UK)	940
3.	<b>"Voice messaging systems - human factors issues"</b> J.A. Waterworth (UK)	943
<hr/>		
L5	Stress and Job Redesign for Middle-Aged and Elderly Workers" Seminar Convenor: M. Kumashiro (Japan)	
3.	<b>"The effects of stress on middle-aged and elderly workers: two case studies"</b> M. Kumashiro (Japan)	946
4.	<b>"Job redesign for middle-aged and old workers"</b> M. Nagamachi (Japan)	949
<hr/>		
L6	"Epidemiology in Ergonomics: Workload Risk Factors and their Consequences for Health" Seminar Convenor: I. Kuorinka (Finland)	
1.	<b>"Occupation, workload and retirement: epidemiology of work strain"</b> I. Kuorinka and M. Nurminen (Finland)	952



- |    |  |     |
|----|--|-----|
| 2. | <b>"Interaction of workload and functional capacity"</b><br>T. Luopajarvi (Finland)                              | 955 |
| 3. | <b>"Confounding and possible bias - examples from an epidemiological study on VDT work"</b><br>B. Knave (Sweden) | 958 |
| 4. | <b>"Standardised questionnaires as tools in the study of work-related illness"</b><br>B. Jonsson (Sweden)        | 961 |
- 

---

M1 POSTURAL FACTORS IN FITNESS FOR WORK

- |    |  |     |
|----|--|-----|
| 1. | <b>"Problems of assessing static postures"</b><br>N.P. Milner, E.N. Corlett and C. O'Brien (UK)  | 964 |
| 2. | <b>"Evaluation of kinetic handling training"</b><br>A.R. Hale (Netherlands) and I.D. Mason (UK)  | 967 |
| 3. | <b>"Identification of risk factors associated with musculoskeletal disorders"</b><br>P.W. Buckle, D.A. Stubbs and D. Baty (UK)           | 970 |
| 4. | <b>"Analysis of the work of nursing aides in a geriatric hospital"</b><br>M. Lortie (Canada)   | 973 |
| 5. | <b>Eigene methode der beurteilung des arbeitsbelastungsgrades in ergonomischen untersuchungen"</b><br>J. Bielski and A. Zeyland (Poland) | 976 |
- 

M2 PARTICIPATORY ERGONOMICS: SPECIFIC PROFESSIONAL ISSUES

- |    |   |     |
|----|---|-----|
| 1. | <b>"Small-group activities: new tendencies in the Federal Republic of Germany"</b><br>K.J. Zink (FRG) | 979 |
| 2. | <b>"Information technology: bipartite management"</b><br>R.G. Rawling (Australia)                     | 982 |
| 3. | <b>"The fundamental laws of psychology and ergonomics"</b><br>V.F. Venda (USSR)                       | 985 |
| 4. | <b>"The nurse and the event"</b><br>J. Theureau (France)  | 988 |
-

M3	"Marketing Ergonomics" Seminar Convenor: G.R. Gallaway (USA)	
1.	<b>"Marketing ergonomics: influencing developers, managers and customers"</b> G.R. Gallaway (USA)	991
<hr/> <hr/>		
M4	"Drivers' Speed, Driving Stress and Accident Records" Seminar Convenors: J.F. O'Hanlon (Netherlands) on behalf of the Human Factors Society, Europe Chapter.	
3.	<b>"Workload and stress in driving"</b> H. Gstalder (FRG)	994
4.	<b>"Ergonomics of vehicle guidance"</b> J. Godthelp and J. Moraal (Netherlands)	997
<hr/> <hr/>		
M5	"Studies of Working Conditions and Health Effects in Offices" Seminar Convenor: B.C. Amick (USA)	
1.	<b>"Work with video display terminals: results and discussion of an epidemiological health study of 550 office employees"</b> B. Knave and U. Bergqvist (Sweden)	1000
4.	<b>"Ergonomics and social epidemiology: where should integration begin?"</b> B.C. Amick (USA)	1003
<hr/> <hr/>		
M6	"How the I.E.A. came into being" Seminar Convenor: R.G. Stansfield (UK)	
1.	<b>"The founding of the International Ergonomics Association"</b> R.G. Stansfield (UK)	1006
2.	<b>Ergonomics and the European Productivity Agency: a historical note"</b> D. Lecoultre (France)	1009

4. "The role of the journal 'Ergonomics' in the development of the I.E.A."  
A.T. Welford (USA) 1012
- 
- 

Index of Authors

Index of Subjects

# M4. DRIVERS' SPEED, DRIVING STRESS AND ACCIDENT RECORDS

---

M4/3 WORKLOAD AND STRESS IN DRIVING

H. GSTALTER

Lehrstuhl für Psychologie, TU München, Lothstr. 17,  
8000 München 2, FRG

## INTRODUCTION

Research in stress and strain has been a point of main interest for the Federal Highway Research Institute in Cologne in the last few years. One study on this topic has recently been conducted and finished at the Technical University of Munich.

The aim of the project was to investigate the relation between information load and perceived stress of car drivers with special regard to the influence of traffic situations and driver characteristics.

## THEORETICAL APPROACH

Working out a methodological approach to the measurement of stress had to be preceded by the layout of a theoretical concept of stress generation and coping processes. We followed a psychological model introduced by Kastner (1978) which is closely connected to the ideas of Lazarus (1966) and McGrath (1976). The interaction between the driver and the traffic situation is modelled as a circle process: the objective situation is perceived by the driver on the background of his personal experiences. The comparison between the perceived demands and the estimated coping possibilities results in a subjective confidence to control the situation and finally leads to decisions between possible plans of action. The importance of the cognitive-emotional parts of the estimation process will decrease for increasing automation of the associated actions. The action itself leads to a change in the

objective situation and thus the circle closes and the whole process starts all over again. The utility of such a model is the possibility of derivating different levels of stress measuring procedures.

#### METHODS

40 male students drove an instrumented car on a standardized way through Munich and its surroundings. 68 urban and rural traffic situations had been chosen and analysed using a questionnaire for task analyses purposes which had to be modified for the study. In each of these thoroughly defined situations the following groups of variables were measured for all drivers:

- (1) The driver ratings of stress intensity, its duration and their perceived degree of control.
- (2) Driver behaviour (e.g. mean velocity, steering wheel movements, break handling).
- (3) Physiological measures (e.g. heart rate, GSR).

In addition to these data pools we investigated the static demands of each situation using the Task Analysis Questionnaire; the dynamic components of the actual situations were scored afterwards by experts from a video tape.

A day before the run the subjects had to score on several personality inventories. In total, a set of 44 variables was measured.

#### RESULTS

Special results from the great body of data gathered during the experiment can of course not be presented here, instead I try to summarise our main findings in a more general form.

1) Stress showed to be a multidimensional construct, stress reactions showed very different patterns of feelings and behaviour as well as in the physiological system.

2) No matter if focus is on the average driver or the average situation, correlations between all variables are rather low. The most consistent and useful indicators were the driver's ratings.

3) The obvious hypothesis of an increasing degree of stress with increasing amount of information being processed could be confirmed, whereas the type of information processing did not lead to differences with respect to the drivers reaction.

4) The amount of stress depends on the kind of traffic situations; but differences between groups of similiar situations are quite small. Thus, finding and eliminating the most stressing types of situations cannot be recommended as a very effective strategy in road safety work.

5) In spite of the homogeneity of our sample of drivers, considerable parts of the variance in our data were originated by inter-driver differences. Groups with different levels of stress and with typical coping styles could be identified.

6) Are the most stressing situations or the most stressed drivers also the most dangerous ones? There is no such simple relation: Where the situation is very demanding, drivers react with a change to more cautious behaviour, typically with a considerable speed reduction. The same holds true with respect to different drivers: those who felt and rated more stress drove significantly slower than other drivers. All correlations between average velocity and stress ratings are negative.

7) Stress indicators, e.g. in the physiological reaction patterns were always associated with higher ratings, i.e. the drivers were always informed about their state of arousal or stress.

#### REFERENCES

- Galsterer, H., Benda, H.v. & Hoyos, C. Graf, 1983, Belastung und Beanspruchung von Kraftfahrern, 3. Teil. Schlußbericht zum Forschungsprojekt 7708 der Bundesanstalt für Straßenwesen, Köln.
- Kastner, M., 1978, Entwicklung von Verfahren und Validierung von Indikatoren zur Beanspruchungsmessung bei Kraftfahrern. Forschungsbericht an die Bundesanstalt für Straßenwesen, Köln.
- Lazarus, R.S., 1966, Psychological stress and the coping process. New York: McGraw Hill.
- McGrath, J.E., 1976, Stress and behavior in organizations. In: Dunnette, M.D. (Ed.): Handbook of Industrial and Organizational Psychology. Chicago: Rand McNally, p. 1351.