

ENVIRONMENTAL ERGONOMICS FUTURE DEVELOPMENTS

Kenneth C. Parsons
Human Modelling Group, Department of Human Sciences
University of Technology, Loughborough
Leics, LE11 3TU, UK

INTRODUCTION

The component disciplines and practical problems associated with Ergonomics have existed and have been addressed for many years, but the subject **has** existed for only about forty years and **has** had wide international impact only in the last ten. It is often identified by its human centred approach to the design and evaluation of products and systems **as** depicted in the often used paradigm:

'man-machine-environment-organisation'

In **this** context Environmental Ergonomics is concerned with methods, techniques and knowledge in the area of how **humans** respond to physical environmental conditions and how these **can** be integrated into an overall Ergonomics investigation or design. This overall investigation will involve the physical, physiological and psychological characteristics of **humans**, the design of -and interaction with- the tools they use, and the effects of the environment and of the organisation in which they 'work'. The view of Environmental Ergonomics in **this** wider context **has** neither been generally identified nor accepted. The establishment of the subject itself will be a significant future development.

WHICH ENVIRONMENTS AND WHAT EFFECTS ARE STUDIED?

In principle the environmental ergonomist is concerned with the effects of the 'total integrated' environment on persons. In practice effects of individual environmental components are **considered**. Traditionally, ergonomists have concentrated on acoustic, lighting, vibration and thermal environments and effects on human health and safety, comfort and performance. These are not exclusive, however, and hypo- and hyperbaric environments, **air** quality, acceleration and others are **as** well important in particular contexts.

The subject **of** human response to the physical environment **has** a broad scope. Wherever humans are involved the subject will apply. The following **will** consider some particular developments **that** are achievable and may occur within the next few years with emphasis on the area of the Ergonomics of the thermal environment.

STANDARDS

A major development in recent years **has** been the production of numerous international standards in ergonomics. Committees are TC 159 for ISO and TC 122 for CEN (European standards). Many of the standards are concerned with human response to thermal environments and they will have influence and generate **great** interest in the subject. Standards for hot, moderate and cold environments have been produced, describing effects of surface temperatures after **skin** contact, metabolic rate, clothing insulation, subjective methods, medical **screening**, instrumentation, physiological measurement and others. Much has been achieved and it is **now** time to **gain** experience with them and reflect on the overall presentation of the standards and how they might be used in practical application.

As well **as** new topics for standardisation, the challenge is for us to integrate existing standards into usable form and provide mechanisms to ensure that when new developments become established they **can** be incorporated into standards.

THERMAL MODELS

Available technology and research has produced computer models that **can**, potentially, be easily used in practical application. Improved data on the human body and its responses and models of heat and **mass**

transfer, particularly through dothing, will **all** contribute. The effects of solar radiation, exercise, anthropometry, pressure, activity, transient exposure and acclimatization could **all** be included.

The lack of availability of software and the poor regard for the 'user interface' have restricted use. Human factors issues about **how** thermal models are used in practical application have yet to be addressed. Models to predict physiological response and comfort are available but a development would be to include models **of** human performance.

KNOWLEDGE BASED SYSTEMS TO COMPUTER AIDED ERGONOMICS

Knowledge based systems, that provide easily accessible information and advice on environmental ergonomics, **exist** in prototype form. Such systems have great potential and **can integrate** thermal models, data-base models, advice, standards and limits and relevant literature into a single system.

Computer Aided Ergonomics is a developing subject and **has** been adopted in areas of anthropometry and manual materials handling. The **inclusion** of thermal models into **such** systems may be a development. The design of the software interface is non-trivial and crucial to the acceptance and use of **such** systems.

OTHER DEVELOPMENTS

An outstanding **failure** in Environmental Ergonomics is that effects on human performance are not understood, despite **much** research. The development of appropriate models of human performance and the ability to make reasonably accurate predictions of the effects of cold on manual performance **can be** expected.

Much discussion and some activity **has** taken place concerning the interaction of environmental components (eg. noise and vibration, cold, light and noise, etc.). **This** work will continue but success **will**, to some extent, depend on an understanding of the effects of individual components.

We are entering a period where practical experience and publication of case studies will **improve** methods and lead towards acceptance of the subject, which **has** much to offer.