

ENVIRONMENTAL ERGONOMICS: FUTURE DEVELOPMENTS

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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 clothing, 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.