FOR WHOM DO WE RESEARCH?

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In his search for knowledge and understanding of the world around him, the pure research scientist has no need of other justification. But for those working in the broad field of ergonomics, possible applications of our results form an important part of the overall objective. The road from the research laboratory to the factory door is long and poorly signposted, and it is populated only thinly with those who are motivated to improve the route and facilitate the flow of traffic. Here is important territory for the ergonomist. Yet too often we are content to research and publish but to leave to others the crucial task of ensuring effective application of our results to the benefit of users. The literature is full of good ideas withering on the vine for want of effective marketing.

From the users' point of view it is important for us to seek a more precise elucidation of the consequences for human performance. of environmental stresses of all kinds. We may establish physiological responses - high body temperature, low arterial oxygen saturation, high heart rates - but our customers need to know whether these matter in a practical sense, and this requires knowledge of effects on performance. This is too **important** a matter to be left to the psychologists alone and it is essential to encourage closer cooperation between physiologists and psychologists in advancing our knowledge in this area. The otherwise excellent and impressively supported Environmental Ergonomic Conferences would be much enriched by more contributions by psychologists.

In passing, some of you may be aware of the exciting advances being made in techniques for measuring brain function. The days of the simple three lead electroencephalogram are numbered and the possibility of physiological measurement of thought processes, emotion and even personality are on the horizon. This is all a long way ahead, but have a look at the excellent work of Munoz and Guitton(1) at the Montreal Neurological Institute demonstrating, inter alia, the presence of retino-topic, tonic discharges in the superior colliculus excited during the mere planning of eye movements. This work provides a tentative mechanistic explanation (pre-excitation of relevant neural circuity), for the facilitation of a series of actions by 'thinking them through' in advance. Perhaps in the long run psychology is really only a branch of physiology that has yet to discover what to measure.

An important aid to user friendliness among ergonomists is the growing use of predictive modelling, yet it attracts both advocates and detractors. One of its most important benefits has been the provision of a basis on which practical advice. to users can be developed. A good example, which has found much practical application is the use of the Texas thermoregulatory model(2) for predicting likely survival times in water. Another model, developed at the Institute of Aviation Medicine at Farnborough for predicting the performance effects of interactions between time on duty and circadian rhythms(3), has proved useful in determining, for example, flight duty time limitations for aircrew. Thus the effort devoted to modelling is of some importance to the user population who, by and large, provide our funding.

Among the advantages of modelling are its ability to focus on important issues where further experimentation could usefully be undertaken to improve predictive accuracy. Bur the process must be one of evolution with a continual exchange of ideas between the modeller and the experimenter in the quest for improvements. Models should not be set in concrete or applied dogmatically; to do so is to limit the benefits and to risk superficial discrediting. One must frequently return to the data and question its precision and, if necessary, repeat experimentation using more modem techniques. It is easy to be dazzled by apparent precision in a model and one must always be aware of the data upon which it was developed. For example, the models upon which flight time limitations are based are derived from laboratory performance testing, but we know rather little about the relevance of laboratory performance tests to real world activities. Perhaps more extensive job analysis techniques might help to determine more precisely those aspects of human performance that are important in a particular activity.

Human variability is *often* advanced as an objection to the modelling approach which is usually based on average results. But practical user policies are mostly tailored for populations rather than individuals. Much of the variability of physiological responses is not inherent in the system but determined by identifiable differences in physical and other characteristics. For example, differences in body temperature responses to immersion can be attributed to differences in fat, metabolic responses, cardio-vascular responses etc, some of which we understand. But there are many yet to be elucidated, providiug both a challenge to the physiologist and an expectation for the modeller that predictive accuracy can be improved Generally, limitations are due to Iack of knowledge rather than modelling capability per se.

I mentioned earlier the important issue of marketing our expertise. User friendliness is one thing, but user ignorance of the value and applications of human factors research has been widespread. In this area there have been some new developments aimed at encouraging industry to take more cognizance of human factors when designing equipment and machinery. Led by the US Amy, a management system has been developed to ensure the proper consideration of human factors in equipment development programmes. It is known as MANPRINT[4] derived from MANpower and PeRsonnel INTegration. The aim is to encourage user-orientated design by contractually obliging industry to consider, throughout the whole development *process* from concept to manufacture and on in to service, the six MANPRINT domains. These are Manpower (number of operators); Personnel (required aptitudes, capabilities and experience of operators); Training Requirements; Human Factors Engineering; System Safety (accident prevention) and Health Hazards. The results of competition between suppliers of equipment will be significantly affected by the extent to which they have successfully demonstrated the user benefits of their proposals.

The MANPRINT approach to a people-orientated design philosophy may be confidently *expected* to increase manyfold the profile of human factors expertise, recognition of its importance and demand (and funding) for research. Meeting that challenge rests significantly in the hands of human factors scientists in the broadest sense. But they also must be sure to be user-friendly.

REFERENCES

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