



Human Factors at TRL

TRL has pioneered many of the world's transport-related human factors studies we see around us in everyday life; from impairment studies of alcohol, recreational drugs and fatigue to the design and specification of the vehicles and systems we see on our roads and railways. Experts from TRL contribute to national and international panels on ergonomics, and staff include many world recognised experts. TRL's research background, consultancy, staff and facilities has a truly outstanding reputation, unique and unrivalled in the transport sector.

Human Factors (also known as Ergonomics) is about people, products, systems and environments, and how they impact on each other. Human Factors is an interdisciplinary profession that focuses on identifying human abilities and limitations within work environments, and then applies that knowledge to improve people's interaction with their environments in order to optimise human well being and overall system performance.

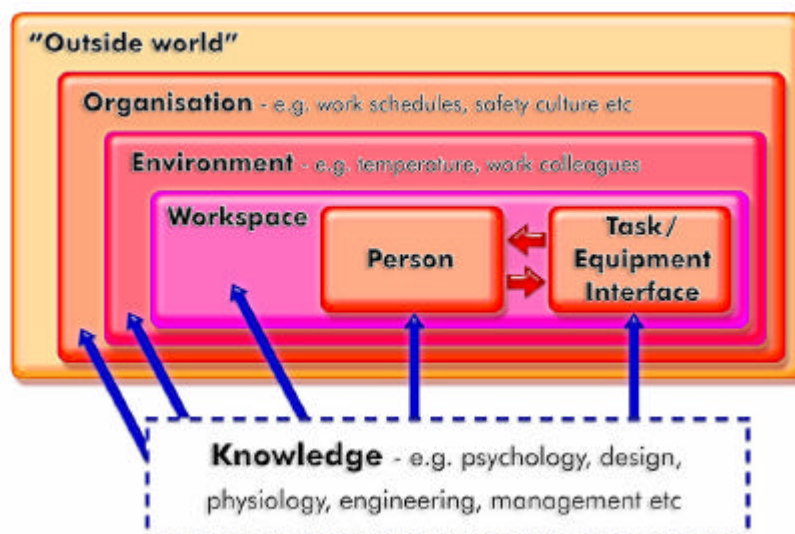
What are the aims of Human Factors?

Human Factors can be thought of as having two separate (but not mutually exclusive) aims:

1. **To improve performance.** This includes quantity of work (e.g. increased human machine integration or increased effectiveness of team working), quality of performance (including fewer errors) and fewer accidents/near misses.
2. **To improve people's health and wellbeing.** For example, fewer occupational injuries, less stress, increased usability of products and increased work motivation.

Underlying the subject is the overriding idea that using human factors' data, principles and methods will lead to better designed jobs, tasks, products or systems.

What are the main parts of Human Factors?



Application oriented model of Human Factors (adapted from Wilson and Corlett, 1992)



The main constituent parts of HF are:

- **Cognitive:** Concerned with individual mental processes, such as perception, decision making, actions and memory. Topics here include human error, situation awareness, work stress, mental workload and training.
- **Environmental:** All of our daily activities are performed in a physical environment. Through the study of basic Human Factors principles with respect to key variables such as sound, temperature and lighting we can identify and interpret how such physical environmental variables are relevant to the design and implementation of systems, tasks and equipment.
- **Organisational/Social:** Generally we do not operate in isolation of other people, so organisational ergonomics is concerned with optimising the 'sociotechnical' system in which we function. This includes traffic environments, organisational structures, communication, working hours, organisational culture and teamwork.
- **Physical:** Concerned with human anthropometric (the science of body sizes), physiological (the science of normal body functions) and biomechanical (the mechanical properties of a moving body) activities, and how they relate to physical activities such as manual handling, vehicle/workplace layout, working postures and work related disorders.



Manual Handling

Human Factors at TRL

TRL has a unique combination of human factors researchers. TRL is a world leading transport research centre with expertise that covers many areas including industrial safety and human computer interaction.

Human Factors should be considered at all stages of a project that involves human operators; for example, this may begin with task analyses and user requirement capture and may end with a user trial and product or system evaluations.

Some of the areas in which our Ergonomists can make a vital contribution include:

Product Assessments, Including Software Systems and In-Vehicle Technologies:

This includes product and software usability, as well as safety and acceptability assessments of new in-vehicle technologies. In the wider context this includes how such technologies could change the nature of the driving task, with possible issues of humans being 'out of the control loop'.



Different Vehicle Interiors



Developing Human Factors Standards and Guidelines:

TRL human factors specialists regularly make contributions to international standards and guidelines. For example, TRL provides expert representation to the main ISO group responsible for development and maintenance of human factors standards related to Intelligent Transport Systems (ITS) in vehicle systems.

HMI Assessments and Redesigns:

TRL has developed an HMI safety checklist with which we can assess driver workload and interaction with multiple displays/warnings, taking into account human abilities and characteristics (including fatigue, vigilance, situation awareness and physical factors and human error).

Task Analysis:

Undertaking analyses of the operators' task, to help understand what the task involves, what information is required, what training is needed, and are the different ways of achieving successful task performance.

Optimising the Design of the Transport Environment:

Including undertaking human factors reviews of the amount of visual information in the road environment (e.g. advertising and other visual clutter) and how this might cause driver behavioural adaptation.



Potential Signing Clutter



Simulated Vehicle Environments

Research and Analysis of Driver and Passenger Behaviour:

For example, measuring the visual behaviour of car or train drivers, simulator studies of driver inattention, analysis of passenger boarding and alighting (including emergency evacuation), or how changing aspects of the visual environment changes driver behaviour. With all of these, the TRL team assess the implications of the results, and, where applicable, propose systems design, policy or training interventions to optimise performance.

Physical Ergonomics Assessments:

Including undertaking human factors reviews of the amount of visual information in the road environment (e.g. advertising and other visual clutter) and how this might cause driver behavioural adaptation.

Training Needs Analysis:

Identifying gaps in knowledge and where and how best to place emphasis on training requirements. This can be done in part through use of simulation.

Pedestrian Environment Review Audits:

This includes a complete review of pedestrian environments, including the assessment of links, crossings, routes, interchange spaces, public spaces and public transport waiting areas. The pedestrian environments are score according to a series of criteria that TRL have developed and incorporated into a software package (PERS).



Reviews of Organisational Factors:

For example reviews, evaluations and revisions of Safety Management Systems, safety culture or work schedules.

Developing Methods:

Identifying and developing appropriate research and test methods. For example, to evaluate the primary and secondary safety performance of vehicles, to assess visual demand in the road environment, or to evaluate operator training.

Human Factors Toolkit

In addition to the experienced ergonomists at TRL, we are fortunate to have access to a range of sophisticated specialist equipment. This includes:

- UK's most advanced full-mission car and truck driving simulators
- A suite of sophisticated experimental laboratories where user trials can be undertaken
- State of the art eye-tracking technologies
- Occlusion goggles to assess driver distraction
- Sophisticated systems to measure dynamic muscle activity
- A large vehicle test track and private road network
- Developers of Human Factors checklists, including for In-Vehicle Information Systems (IVIS)
- Instrumented vehicles, video recording and analysis equipment and stand alone impairment tests
- Wide range of questionnaires and databases in a comprehensive transport research library
- Direct access to other professionals within TRL, including safety engineers, vehicle designers, statisticians, psychologists and traffic engineers
- Unique contacts and access to other human factors professionals around the world
- Advanced safety, quality and reporting procedures, together with an established track record in successfully completing work on time and to budget.



TRL's Advanced Car Driving Simulator



CarSim Control Room

For further information on Human Factors and how TRL can help you please contact:

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