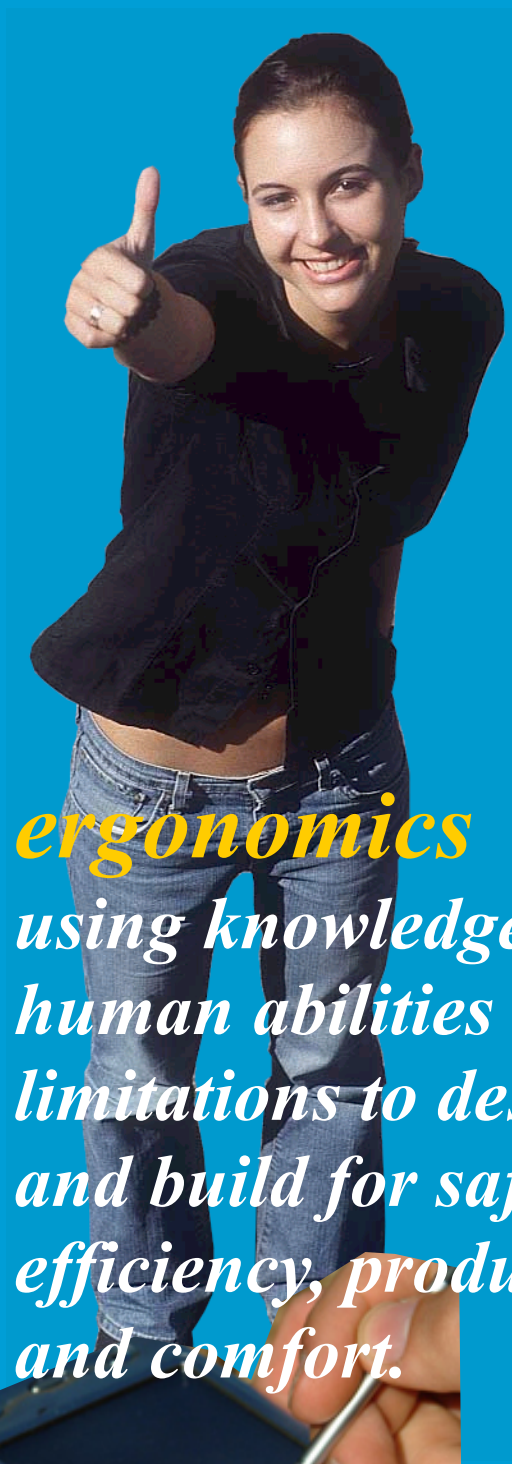
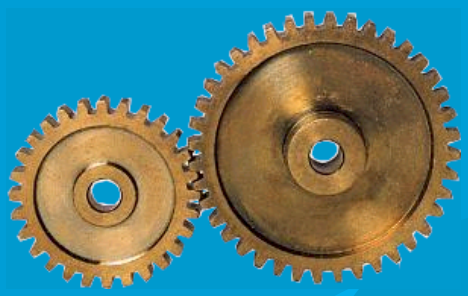
a career in ergonomics





ergonomics

using knowledge of human abilities and limitations to design and build for safety, efficiency, productivity and comfort.

0110 0110101
11101010100
0001000111

THE Ergonomics society

a career in ergonomics

Thinking of becoming an Ergonomist?

A career in ergonomics can be both challenging and rewarding. Once you have graduated, you may want to specialise in a certain area, work on your own or become part of a team. Whatever you decide, there are some things that you need to know before you start your course of study, to make sure that you keep your options open and don't miss out on any exciting career opportunities...

- Some courses, such as those offered by Loughborough University, may run to four years which includes a year of practical experience.
- Employers usually prefer students who have some industrial experience.
- Programmes usually welcome students who have taken a 'gap year' between school and university.
- At Loughborough, the difference between the ergonomics programmes and the psychology with ergonomics programmes is that the former includes the study of biological aspects of humans (e.g. anatomy & physiology, biomechanics, anthropometry, and so on) whereas the psychology with ergonomics programmes have no biological modules (though you could take an optional module or two).
- Note that if you choose to study psychology with ergonomics, you'll be unqualified to practise in some areas of ergonomics, such as health & safety. On the other hand, you'll be well-equipped to practise in areas such as human-computer interaction, along with other ergonomists and computer scientists.
- Few programmes make specific requirements for A-level topics. Students may have a very varied education at A-level; an example is theology, fine art and history of art. However, a 'good' combination at A-level (meaning that you might not have to work so hard later on) would be mathematics, physics and biology, or mathematics, physics and psychology.
- Because of the breadth of understanding needed to be a good ergonomist, presenting a wide range of topics at A/S and A-level is actually an advantage in the long term. For example, 2 A-level subjects and 2 different A/S-level subjects is a good combination, as is 1 A-level and 4 different A/S-level subjects.
- Jobs are available in a very wide range of industries. In fact, we believe that it's harder to get onto some university courses than it is to find a job afterwards!

For more information visit www.ergonomics.org.uk/training/education.htm

a career in ergonomics

What is ergonomics?

A definition of ergonomics

Why is the video recorder one of the most frustrating domestic items to operate? Why do some car seats leave you aching after a long journey? Why do some computer workstations confer eyestrain and muscle fatigue? Such human irritations and inconveniences are not inevitable – ergonomics is an approach which puts human needs and capabilities at the focus of designing technological systems. The aim is to ensure that humans and technology work in complete harmony, with the equipment and tasks aligned to human characteristics. Ergonomics has a wide application to everyday domestic situations, but there are even more significant implications for efficiency, productivity, safety and health in work settings. For example:

- Designing equipment and systems including computers, so that they are easier to use and less likely to lead to errors in operation – particularly important tin high stress and safety-critical operations such as control rooms.
- Designing tasks and jobs so that they are effective and take account of human needs such as rest breaks and sensible shift patterns, as well as other factors such as intrinsic rewards of work itself.
- Designing equipment and work arrangements to improve working posture and ease the load on the body, thus reducing instances of Repetitive Strain Injury/Work Related Upper Limb Disorder.
- Information design, to make the interpretation and use of handbooks, signs, and displays easier and less error-prone.
- Design of training arrangements to cover all significant aspects of the job concerned and to take account of human learning requirements.
- The design of military and space equipment and systems – an extreme case of demands on the human being.
- Designing working environments, including lighting and heating, to suit the needs of the users and the tasks performed. Where necessary, design of personal protective equipment for work and hostile environments.
- In developing countries, the acceptability and effectiveness of even fairly basic technology can be significantly enhanced.

A multi-disciplinary science

The multi-disciplinary nature of ergonomics (sometimes called ‘Human Factors’) is immediately obvious. The ergonomist works in teams which may involve a variety of other professions: design engineers, production engineers, industrial designers, computer specialists, industrial physicians, health and safety practitioners, and specialists in human resources. The overall aim is to ensure that our knowledge of human characteristics is brought to bear on practical problems of people at work and in leisure. We know that, in many cases, humans *can* adapt to unsuitable conditions, but such adaptation leads often to inefficiency, errors, unacceptable stress, and physical or mental cost.

The components of ergonomics

Ergonomics deals with the interaction of technological and work situations with the human being. The basic human sciences involved are **anatomy**, **physiology** and **psychology**, these sciences are applied by the ergonomist towards two main objectives: the most productive use of human capabilities, and the maintenance of human health and well-being.

In a phrase, the job must 'fit the person' in all respects, and the work situation should not compromise human capabilities and limitations.

The contribution of basic **anatomy** lies in improving physical 'fit' between people and the things they use, ranging from hand tools to aircraft cockpit design. Achieving good physical fit is no mean feat when one considers the range in human body sizes across the population. The science of anthropometrics provides data on dimensions of the human body, in various postures. Biomechanics considers the operation of the muscles and limbs, and ensures that working postures are beneficial, and that excessive forces are avoided.

Our knowledge of human **physiology** supports two main technical areas. Work physiology addresses the energy requirements of the body and sets standards for acceptable physical workrate and workload, and for nutrition requirements. Environmental physiology analyses the impact of physical working conditions – thermal, noise and vibration, and lighting – and sets the optimum requirements for these.

Psychology is concerned with human information processing and decision-making capabilities. In simple terms, this can be seen as aiding the cognitive 'fit' between people and the things they use. Relevant topics are sensory processes, perception, long- and short-term memory, decision making and action. There is also a strong thread of organizational psychology. The importance of psychological dimensions of ergonomics should not be underestimated in today's 'high-tech' world – remember the video recorder example at the beginning. The ergonomist advises on the design of interfaces between people and computers (Human Computer Interaction or HCI), information displays for industrial processes, the planning of training materials, and the design of human tasks and jobs. The concept of 'information overload' is familiar in many current jobs. Paradoxically, increasing automation, while dispensing with human involvement in routine operations, frequently increases the mental demands in terms of monitoring, supervision and maintenance.

The ergonomics approach – understanding tasks … and the users

Underlying all ergonomics work is careful analysis of human activity. The ergonomist must understand all of the demands being made on the person, and the likely effects of any changes to these – the techniques which enable him to do this come under the portmanteau label of 'job and task analysis'.

The second key ingredient is to understand the users. For example, 'consumer ergonomics' covers applications to the wider contexts of the home and leisure. In these non-work situations the need to allow for human variability as at its greatest – the people involved have a very wide range of capabilities and limitations (including the disabled and elderly), and seldom have any selection or training for the tasks which face them.

This commitment to 'human-centred design' is an essential 'humanizing' influence on contemporary rapid developments in technology, in contexts ranging from the domestic to all types of industry.

David Whitfield & Joe Langford
The Ergonomics Society

From Blakemore C and Jennett S (eds) The Oxford Companion to the Body (Oxford University Press, 2001). Reprinted by kind permission of Oxford University Press. For further information about OUP publications, visit www.oup.com.

a career in ergonomics

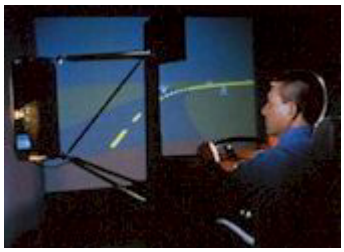
Using ergonomics

Size and shape

Some years ago, researchers compared the relative positions of the controls on a lathe with the size of an average male worker. It was found that the lathe operator would have to stoop and move from side to side to operate the lathe controls. An ‘ideal’ sized person to fit the lathe would be just 4.5 feet tall, 2 feet across the shoulders and have an arm span of 8 feet!

This example epitomises the shortcoming in design when no account has been taken of the user. People come in all shapes and sizes, and the ergonomist takes this variability into account when influencing the design process. The branch of ergonomics that deals with human variability in size, shape and strength is called anthropometry. Tables of anthropometric data are used by ergonomists to ensure that places and items that they are designing fit the users.

Vision



Vision is usually the primary channel for information, yet systems are often so poorly designed that the user is unable to see the work area clearly. Many workers using computers cannot see their screens because of glare or reflections. Others, doing precise assembly tasks, have insufficient lighting and suffer eyestrain and reduced output as a result.

Sound

Sound can be a useful way to provide information, especially for warning signals. However, care must be taken not to overload this sensory channel. A recent airliner had 16 different audio warnings, far too many for a pilot to deal with in an emergency situation. A more sensible approach was to have just a few audio signals to alert the pilot to get information guidance from a visual display.

One goal of ergonomics is to design jobs to fit people. This means taking account of differences such as size, strength and ability to handle information for a wide range of users. Then the tasks, the workplace and tools are designed around these differences. The benefits are improved efficiency, quality and job satisfaction. The costs of failure include increased error rates and physical fatigue - or worse.

Human error

In some industries the impact of human errors can be catastrophic. These include the nuclear and chemical industries, rail and sea transport, and aviation, including air traffic control. When disasters occur, the blame is often laid with the operators, pilots or drivers concerned - and labelled 'human error'. Often though, the errors are caused by poor equipment and system design. Ergonomists working in these areas pay particular attention to the mental demands on the operators, designing tasks and equipment to minimise the chances of misreading information or operating the wrong controls, for example.

a career in ergonomics

Ergonomic design

Product design

Even the simplest of products can be a nightmare to use if poorly designed. Our ancestors didn't have this problem. They could simply make things to suit themselves. These days, the designers of products are often far removed from the end users, which makes it vital to adopt an ergonomic, user-centred approach to design, including studying people using equipment, talking to them and asking them to test objects. This is especially important with 'inclusive design' where everyday products are designed with older and disabled users in mind.

Age related design

The number of people in the UK aged 75 and over is forecast to double over the next 50 years. As such, there is a need to extend the range of application of equipment, services and systems designed for the general population. Data needs to be available on relevant aspects of the capability of the whole population including older and disabled people. The aspects include the physiological (for instance, range of limb movement, strength, vision, hearing) and the psychological (for example, cognitive, reaction time, memory). Anthropometric data is also required (size and shape ranges of people). With data such as this available, a knowledge base can be generated for access by conscientious designers.

Quality of life for older and disabled people may also be enhanced by improvements in the built environment. This includes design of the home, design of public access buildings and public spaces, and design and operation of transport systems. Physical aspects of design that need to be considered include stairs and ramps, hygrothermal conditions (cold, damp, heat), security and accessibility. Sensory aspects include acoustics, lighting, comfort, communication systems, signage and navigation.

Design of information

Much of today's human factors research and expertise is channelled towards improving the ways we use information. Virtually everyone has experienced the frustration of using computer software that doesn't work the way they expect it to. For the majority of end users of computer programmes, if the system is not working they have no recourse but to call for technical help, or find creative ways around system limitations, using those parts that are usable, and circumventing the rest or increasing stress levels by using a substandard system. Often the problems in systems could have been avoided, if a more complete understanding of the users' tasks and requirements had been present from the start. The development of easily usable human-computer interfaces is a major issue for ergonomists today.

a career in ergonomics

Working as an ergonomist

James Bunn *works as an ergonomist for the Health and Safety Laboratory (HSL), an agency of the Health and Safety Executive (HSE). HSE is a government body that, with the UK Health and Safety Commission, is responsible for regulating the majority of risks to health and safety arising from work activity in the UK.*

“My work mainly involves providing scientific expertise that's used by HSE for supporting enforcement decisions. When a HSE inspector identifies a possible ergonomics issue within a particular company in industry that needs investigating, I go out to the site and record details about the workplace, take measurements and talk to people. For example, if a particular task or process is perceived to carry a high risk of musculoskeletal injury, the inspector will ask me to come along to make an ergonomics assessment.

Most of my work is based around manual handling; particularly musculoskeletal disorders (MSDs) and work related upper limb disorders (WRULDs) that arise from poor working postures and the effect of repeated or sustained loads and forces on the body.
After making a visit, I write a report in which I describe the task that has been identified as carrying a risk of musculoskeletal injury, and assess the various factors in the task that might contribute to injury. These might include a poorly designed workstation, a pace of work that is too fast, handling loads that are too heavy, and holding awkward postures for long periods. I'll suggest short and long-term solutions that the company should introduce. These might include reducing weights and loads, using mechanical handling aids, improving the monitoring of worker's health, or introducing a job rotation scheme. The report can be used as evidence in court if required.

In addition to this work, I also carry out longer-term projects. For example, I'm involved with developing best practice guidance for specific industries that have a high incidence of musculoskeletal injury. This work involves visiting different sites and recording examples of good and ergonomics practice, and also developing solutions that might help to improve problem tasks.

I like the fact that I get to look at such a variety of industries and that I'm able to help people. It's a positive role to be in. I provide advice and I'm also using my scientific knowledge on a daily basis. There are also lots of opportunities to carry out interesting research in this job, and in the field of ergonomics in general.

There are good career opportunities within ergonomics because it's such a broad area. An ergonomist can practise a bit of everything, or specialise as I've done in manual handling. My first degree was in psychology, then after considering other types of jobs, I decided to take the MSc in Ergonomics at Loughborough, where I gained a good background in the subject. It was fairly easy to find a job when I finished my degree and I valued the fact that I could start my current job without having to any additional training, apart from in HSE procedures.”

Text courtesy of the Association of Graduate Careers Advisory Services

a career in ergonomics

Working as an ergonomist

Charlotte *previously gained a BSc (Hons) in Ergonomics at Loughborough University. She now researches and teaches in ergonomics within Loughborough's Department of Human Sciences.*

"I'm currently undertaking research into health among older people, looking specifically at falls - why older people fall in the home and how we can prevent it. My research involves visiting older people in their homes and undertaking psychological and physiological measurements. The research combines the scientific with the human, looking at the behaviour of people, their physical abilities and the design of the home and seeing how all of these interact. I'm also involved in projects that are aimed at investigating health and safety in construction. This involves going onto site and talking to people about what they do, particularly after accidents have happened. You get to find out about so many different jobs and environments

I teach on the BSc (Hons) Ergonomics programme at the University and my subject areas include ergonomics and design, anatomy, physiology, psychology and research methods. The teaching incorporates lectures, practical classes, tutorials and student projects. There's a lot of variety in my job, with activities ranging from writing detailed reports, getting out and about meeting people and finding out about what they do, and assessing the body and how it works. I didn't want to be stuck in a lab-based job.

There are many different aspects to ergonomics, such as anthropometry, the study of the size and shape of people. This has a vital impact on everyday life, for example in safety testing and planning in the design of new products such as cars, trains, and accommodation. Ergonomics uses psychological, physiological and anatomical knowledge of the human body for design purposes and is all about good design, with the user as the starting point. It's always focused on thinking about the user, assessing their needs and asking them what they want.

There are lots of opportunities for consultancy in ergonomics too. These might include working on projects that have an important role in the real world such as accident/disaster investigation, the design of training programs, the design of safety critical systems, and the development of user-friendly computer based software.

Students considering working or studying a science or design course should consider the range of areas covered by ergonomics including psychology, engineering, anatomy, physiology and design. Ergonomics provides the opportunity to put theory to very practical use. In most situations, ergonomics looks at the whole system rather than one small part. It also incorporates many aspects of a situation instead of just looking at purely scientific or physiological aspects. At the same time, it's always putting theory to practical use, with the users of systems or products in mind at all times."

Text courtesy of the Association of Graduate Careers Advisory Services

a career in
ergonomics

Educational courses in ergonomics

To qualify as an ergonomist, you can either take a first degree in ergonomics, or if you have studied a related subject, such as engineering, design, psychology, biology or medicine, you can complete a masters degree. Graduates from the following first degree and post graduate courses are eligible for Graduate Membership of the Society.

First Degree Courses

BSc (Hons) Ergonomics
Loughborough University (either 3 or 4 year course, dependent on whether you take an industrial placement). *See www.lboro.ac.uk/departments/hu/prospect.html.*

BSc Psychology with Ergonomics
Loughborough University. *See www.lboro.ac.uk/departments/hu/prospect.html.*

Post Graduate Courses

MSc Ergonomics
Loughborough University. *See www.lboro.ac.uk/departments/hu/prospect.html.*

MSc Human Factors in Manufacturing Systems
University of Nottingham. *See www.nottingham.ac.uk/school4m/postgraduate/mschfms/indexcurr.htm.*

MSc in Health Ergonomics
Robens Institute of Health Ergonomics, University of Surrey. *See www.eihms.surrey.ac.uk/robens/erg/MSccourse.htm.*

MSc in Human-Computer Interaction with Ergonomics
University College London. *See www.uclic.ucl.ac.uk/courses/.*

Other courses

Graduates from these courses can join the Ergonomics Society as an Associate Member and then, depending on their subsequent work experience and knowledge, may be eligible to apply for Registered Membership.

BSc Psychology with Occupational Psychology
University of Hull. *See www.hull.ac.uk/psychology/psy.htm*

MSc Occupational Psychology
University of Hull. *See www.hull.ac.uk/psychology/psy.htm*
University of Nottingham. *See www.nottingham.ac.uk/prospectuses/postgrad/information.phtml*
London Guildhall University. *See www.londonmet.ac.uk/courses/postgraduate-study/*

MSc Industrial Psychology
University of Hull. *See www.hull.ac.uk/psychology/psy.htm*

MSc Occupational Health Psychology
University of Nottingham. *See www.nottingham.ac.uk/prospectuses/postgrad/information.phtml*

MSc Human Factors
University of Leeds. *See www.psyc.leeds.ac.uk/courses/MSc/HumanFactors/*

a career in ergonomics

Finding more information about ergonomics

Useful websites

www.ergonomics.org.uk
The Ergonomics Society – the UK organisation representing ergonomists and human factors specialists.

www.ergonomics4schools.com
A website from the Ergonomics Society providing information about a wide range of ergonomics topics from aesthetics to manual handling, from lighting to product design.

www.hfes.org/careerguide/index.html
Careers information from the North American Human Factors & Ergonomics Society.

www.designcouncil.org.uk
See the What is Design and What is Ergonomics information on the Design Council website.

Recommended Reading

Ergonomics for Beginners – A Quick Reference Guide
J Dul and B Weerdmeester (published by Taylor & Francis)
Some public libraries have a copy of this book.

The Design of Everyday Things
D A Norman (published by The MIT Press)

For any other information, contact the Ergonomics Society, Elms Court, Elms Grove, Loughborough, Leics, LE11 1RG, telephone 01509 234904, email ergsoc@ergonomics.org.uk.