Editorial

Intellectual life is presumed to be an essential part of any professional society or industrial organization. How is this formal activity generated and by whom is its effectiveness monitored? A traditional approach has been community evaluation of the quality of its specialized education or training; its published research, meeting agendas and conference proceedings; and the level of informed discussion issuing from those sources. An official journal is seen as one of the most valuable components of post-graduate development in any given field. Most professional journals begin life as an informal members’ newsletter designed to inform and bond the early practitioners of a particular discipline. Later there is a need for a more formal medium to record developments in the practice of that discipline. As with Ergonomics Australia a professional journal is likely to begin by accepting all contributions. The next step on the ladder of academic acceptability is to ensure that the journal publishes articles that have been subject to a formal review process.

Ergonomics Australia has been developing along those lines and since 2004 has been listed with the Australian Government’s database of refereed journals. However, this may be at risk, as the bar is being raised. A recent call to the editor advised that future listings will depend on a Research Quality Framework (RQF) which monitors journal impact factors. When queried as to the meaning and application of this RQF assessment, she was advised that to have a journal acknowledged as a refereed journal by internationally accepted criteria, it would need to have an established quotient of citations in other publications. Large publishers (such as Taylor and Francis; and Elsevier) apparently have computer software that tracks the level of citations across a wide range of international journals … but this is light years away from presently available HFESA information technology or even human hours to set it up and scan the reference lists across the range of likely journals … unless someone out there cares to volunteer?

The editor has been advised that a further escalation of criteria relating to international conference recognition also is being considered: namely that a benchmark of fifty percent of submissions will have been rejected. Perhaps that would ensure fewer parallel sessions at large events, and smaller, more focused attendance, but is that likely to be the aim of the organizers? This seems a very arbitrary approach that may satisfy a prevailing bureaucratic culture—but does it truly guarantee quality and academic stimulation of the broad practitioners’ profile?

This is a new hurdle for national professional societies seeking to develop first-rate professional communication tools. In the past it would seem that national journals servicing members of an international discipline encouraged the development of the formal content and presentation skills of students, new academic and practitioner members, as well as promoting the work of more seasoned professionals. This dual approach benefited all members of the society. Unfortunately, as the pressure to publish has steadily increased in academia, there has been an inevitable trend for some experienced ergonomists to restrict their material to international journals for which the RQF impact factors are monitored.

The editor remains grateful to those experienced authors who have continued to support Ergonomics Australia in the belief that it is an invaluable part of a national professional identity. The review process is necessary to justify the quality—and even existence—of this journal. Most authors are grateful for the referees’ opinion/advice and work with the editor to achieve a desirable standard. Sadly, not all papers are finally acceptable. Given the small pool of available material on hand at any time, this can play havoc with the planned schedule for a particular edition. This is a difficult issue at a time when quantity is limited—yet quality is the only justification for existence.

In this edition, courtesy of Wendy Macdonald (presenter) and Jenny Kerr (HFESA 2005 Canberra Conference Co-ordinator) the Ron Cumming Memorial Lecture is published in these pages. It is a very thought provoking paper and should arouse considerable interest and debate since the issue is extremely relevant to all ergonomists. This polemic is fundamental to addressing the profession’s concern with its public image and future direction.

David Brown has re-opened the section: “What every ergonomist needs to know about …” It would be invaluable if other members would consider making a similar contribution. There are a number of papers currently in the pipeline for the June issue: two from overseas and one from a student. The process of review and preparation is running parallel with efforts to get this edition ready for publication … the pre-and post Christmas hiatus seems to be a traditional editorial dilemma. So please think about making a contribution to the journal—it needs to have more than one paper at a time being prepared for publication if it is to develop a more reliable publishing time framework. Just a reminder—as in spite of details being published in each edition, the editor is constantly asked about deadlines— the editions are scheduled for March, June, September and December, with material due by the first of the previous month: 1 February, 1 May, 1 August and 1 November.

Shann Gibbs PhD
Editor
From the internet

Hearts
A mechanic was removing the cylinder head from the engine of a Jaguar when he spotted a well-known heart surgeon in his garage. The surgeon was waiting for the service manager to come and take a look at his car. The mechanic shouted across the garage,

"Hey, Doc, could I ask you a question?"

The surgeon, a bit surprised, walked over to the mechanic. The mechanic straightened up, wiped his hands on a rag and asked,

“So Doc, take a look at this engine. I open its heart, take valves out, fix ‘em, put ‘em back in, and when I finish, it works just like new. So how come I get such a small salary and you get the really big bucks when you and I are doing basically the same work?"

The surgeon paused, smiled and leaned over, and then whispered to the mechanic:

“Try doing it with the engine running.”

The Universal Laws of Computing
For every function, there is an equal and opposite malfunction.

When computing, whatever happens, behave as though you meant it to happen.

When you get to the point where you really understand your computer, it’s probably obsolete.

The first place to look for information is in the section of the manual where you least expect to find it.

When the going gets tough ... upgrade.

To err is human... to blame your computer for your mistake is downright natural.

He who laughs last probably made a back-up.

A complex system that does not work is invariably found to have evolved from a simpler system that worked just fine.

The number one cause of computer problems is computer solutions.

A computer program will always do what you tell it to do, but rarely what you want it to do.

If at first you do not succeed, blame your computer.

Announcing the new Built-in Orderly Organized Knowledge Device (BOOK)
It’s a revolutionary breakthrough in technology: no wires, no electric circuits, and no batteries, nothing to be connected or switched on. It’s so easy to use even a child can operate it. Just lift its cover. Compact and portable, it can be used anywhere—even sitting in an armchair by the fire—yet it is powerful enough to hold as much information as a CD.

Here’s how it works: Each BOOK is constructed of sequentially numbered sheets of paper (recyclable), each capable of holding thousands of bits of information. These pages are locked together with a custom-fit device called a binder which keeps the sheets in their correct sequence. By using both sides of each sheet, manufacturers are able to cut costs in half. Each sheet is scanned optically, registering information directly into your brain. A flick of the finger takes you to the next sheet.

The BOOK may be taken up at any time and used by merely opening it. The "browse" feature allows you to move instantly to any sheet, and move forward or backward as you wish. Most come with an "index" feature, which pinpoints the exact location of any selected information for instant retrieval. An optional “BOOKmark” accessory allows you to open the BOOK to the exact place you left it in a previous session --- even if the BOOK has been closed. BOOKmarks fit universal design standards; thus a single BOOKmark can be used in BOOKs by various manufacturers.

Portable, durable and affordable, the BOOK is the entertainment wave of the future, and many new titles are expected soon, owing to the surge in popularity of its programming tool, coming soon, the Portable Erasable-Nib Cryptic Intercommunication Language Stylus.....

THE LAST WORD: The Bathtub Test
During a visit to a mental asylum, a visitor asked the Director what the criterion was which defined whether or not a patient should be institutionalized.

“Well,” said the Director, “we fill up a bathtub, and then we offer a teaspoon, a teacup and a bucket to the patient and ask him or her to empty the bathtub.”

“Oh, I understand,” said the visitor. “A normal person would use the bucket because it’s bigger than the spoon or the teacup.”

“No,” said the Director,

“A normal person would pull the plug. Do you want a bed near the window?”

Shann Gibbs
Happy New Year! ... although it already seems a long time since the onset of ’06. I hope everyone emerged on this side of the Christmas break safely and happily. The Executive had the pleasure, just after Christmas, of undertaking the “physical decommissioning” of our Canberra office (i.e., sorting and packing boxes) and relocating it to Sydney. As you may recall from the last edition of EA, this move was a necessary, albeit temporary, one.

During the course of “screening and cleaning” our systems, a number of problems and gaps in our member database and its associated procedures have become apparent. We are working to resolve these in conjunction with the revamp of our ICT infrastructure (see below). Our new Secretariat, Pauline Pertel, had to hit the ground running and she has done an outstanding job of “getting up to speed” with our Society’s multifaceted and occasionally complex machinery. There is, however, still much to do and your good will and patience will be very much appreciated. Particular thanks must go to our Treasurer, Louise Whitby, for overseeing the commissioning of our new office – the time and effort she has put in has been well beyond the call of duty.

Our new “i-Manager”, Regina Huntington, recently spent a day at the new office in Baulkham Hills and has begun working on the invisible but critical aspects of our computing and communication (including Web) systems. She is currently progressing with the design, set-up and trial of our forthcoming on-line payment gateway. Intimately linked with this initiative are our database and record-keeping systems and Regina is also working on these. Intrinsic to these systems are issues of privacy and access, and while this has been the source of some consternation, it is important that they be developed in conjunction with our systems and with “best practice” in mind.

Clearly, we are in a period of significant transition – some difficulties will inevitably arise with communications and records until we have managed to bring our systems into the 21st century. Importantly, however, we are well on the way and, with a stable, efficient and effective administrative foundation, we can then proceed to concentrate on the more pressing issues of professionalism and promotion of Human Factors and Ergonomics in Australia.

There are many changes afoot which may have an impact either directly or indirectly on our profession and which will require our focussed attention in the near future. Not least among these are federal changes to the government of national OHS in the form of the new Australian Safety and Compensation Council (ASCC) and the role that professional societies such as the HFESA will play in influencing policy in the arenas of design and injury prevention. For us to make meaningful inroads in these areas may require concerted efforts beyond what volunteer, unpaid participation can afford. We may, therefore, see increasing use in the future of our funds to support specific projects that accord with our professional objectives. Recommendations, or simply suggestions, along these lines are encouraged and always welcome from members.

This is also the first EA since our 2005 Annual conference last November. As most of you would know – either from your presence or the feedback in the Newsletter – it was a resounding success for one of the “mini”-variety of conferences and, as I said in the Newsletter, was unquestionably “maxi” in quality and value.

The conference was preceded, as usual, with the final Board meeting for the year. Shortly afterward, we were able to confirm – and I take very great pleasure in formally announcing – the nomination and acceptance of Robin Burgess-Limerick, Angela Summers and Margaret Cook as, respectively, the incoming President, General Secretary and Treasurer. As is our usual practice, Robin will now take his place on the Board as President-Elect for 2006. The new Executive will take over at the AGM to be held during the 2006 Annual Conference in Sydney.

I would also like to again formally congratulate this year’s honours and awards winners – Wendy Macdonald (Cumming Memorial Lecture and Medal), Barbara McPhee (Society Medal), Neil Adams Snr (Fellow) and Catherine Cook, Robin Burgess-Limerick and Sophia Papalia (Alan Welford Award) – and also again thank the Canberra Conference Committee for their outstanding efforts – Jenny Kerr, Dianne West, Wendy Elford, Lenore Gunning, Lynn McAtamney, Rhonda Berry, Kerry Plunkett, Margaret Kennedy and Margaret Head.

As can be seen from our conferences and awards, Human Factors and Ergonomics work and research in Australia – although limited in numbers by our relatively small population – is of a quality that is second to none. However, we are a diverse group – geographically as well as intellectually – and overt communication and “flag waving” has never been a typical Australian trait. Yet we do ourselves and, more importantly, our governments, communities and industries, a disservice if we don’t become more active in promoting our work, our research, our Society and our discipline. So help us to wave the various flags – let the HFESA be the flagpole, so to speak. Write in and tell us – whether via the Secretariat, the Board, the PAB, the Newsletter or Ergonomics Australia – about what is happening in Human Factors/Ergonomics in your disciplinary or geographical area.

Very best regards to all,

Max Hely
President, HFESA
February 2006
From April 1st there were one hundred days to go for the 16th World Congress on Ergonomics. Now we are sure that the program is at its full extent: about 1,000 oral presentations, 25 interactive sessions (workshops, round table, hands on sessions) and more than 250 posters. The number of people who have registered grows quickly and is now already over 1,100. We expect some fifteen hundred participants, so it will be a large congress, but not too large.

During the congress week, from 9–14 July, the congress venue, the Maastricht Exhibition and Congress Center, is exclusively available for IEA2006. All sessions will be held in the center, under one roof.

At this moment the full papers are sent to Reed Elsevier for the proceedings. The plenary papers have already been submitted to Applied Ergonomics. In your ergono-mically designed congress bag you will find the proceedings CD-rom with all full papers and the special issue of Applied Ergonomics.

The preliminary program is now being processed. This is a complex task; we have logical considerations (which sessions can be held parallel, and which can better be sequential), practical (which sessions to be held in which rooms, based on the expected attendance), time schedules of moderators, and taking into account people are a session chair or who present two papers. In total 250 sessions have to be planned over less than 5 full days and 20 rooms. Early June the full program will be available on the Internet. Theme’s with many sessions are: Health Care Ergonomics; Work related MusculoSkeletal Disorders; Organizational Design and Management; Applied Ergonomics in Design; Building and Construction; Slips, Trips and Falls; Vehicle Ergonomics; Smart Transport; Aging; Ergonomics in Schools/for Children; Virtual Reality; Human Computer Interaction. A new theme is Ergonomics Quality In Design, an initiative of the IEA towards a standardized certification for design processes.

For your convenience we offer several practical solutions.

Posters can be printed free of charge at the congress; Océ Copiers, a major sponsor of the congress offers this service.

There is a central room where all the power points can be uploaded. The people of this service take care that your presentation is available in the appropriate room.

We regret that we cannot provide wireless Internet facilities, but sufficient cables and PCs are available for you to keep contact with the rest of the world. Besides, most hotels offer Internet connections.

You’ll have free public transport in Maastricht down town. If the weather is good, which we of course expect, you’ll find out that almost all facilities in town are at walking distance.

Lunches are served included in the congress fee. During lunch you can visit the exhibition with our sponsors: companies and organization from different countries presenting many features of ergonomics. IEA Committees have meetings during lunchtime or in the end of the afternoon. Most of these meetings welcome newcomers.

For students there will be “meet the expert” lunches: famous ergonomists invite students to discuss matters of their expertise.

Most interactive sessions have a limited access. As from Sunday afternoon you can register for the sessions at the congress venue.

People who are new in the IEA-society will be received a warm welcome by the many Dutch attendees. The Society of Dutch Registered Ergonomists (REN) will pay special attention to those who want company for dinner. You can simply join them in their booth at the exhibition.

As announced before, on Sunday night July 9, directly after the welcome reception, you are invited to watch the World Cup Soccer final match on large screens in the congress center.

The congress party on Wednesday July 12 is going to be a major event. Excellent food and drinks, good and not too noisy music, entertainment is going to be your part. The entrance fee kept very low, so that no one should worry about the cost; for less than a simple dinner down town, you can join the party.

What should I say more? IEA2006 is certainly a must to attend!

We look forward to welcome you!

Ernst A.P. Koningsveld
IEA2006 Congress Chair

MORE INFORMATION: www.iea2006.org
What Do ‘Ergonomists’ Do?

Wendy Macdonald

The title of this paper is deliberately ambiguous. It is intended to encompass the questions of what ergonomists might be assumed to do, based on formal definitions of the nature of “ergonomics”; what current ergonomists are actually doing; and finally, what we should be doing to ensure that ergonomics prospers into the future – in the angst-ridden sense of “what do we do now?”

Underlying these questions are assumptions about the nature of ergonomics, and about the core expertise required of all ergonomists. These issues are complicated by the fact that ergonomics is applied within many different domains that differ substantially in the skills and knowledge required of ergonomists, with resultant substantial differences across domains in the expertise of ergonomists whose practice is largely domain-specific. A further complication is that many non-ergonomists are engaged in implementing some aspects of ergonomics within their own particular domain, and that these people greatly outnumber professional ergonomists.

I argue that the future development and promotion of ergonomics will be best served by promoting the more widespread implementation of ergonomics knowledge—regardless of whether or not the people implementing them could claim to be ergonomists. On this basis, I identify some of the issues that I think HFESA should consider during the current review of the Society’s goals and associated strategies.

1. What Is Ergonomics?

The easy answer here is that ‘ergonomics’ is whatever ergonomists are currently being paid to do. Unfortunately, that kind of answer does not allow us to evaluate differences between the work of ergonomists at different times in history, or between different countries, or between different application domains. For the present purpose, I therefore accept the current definition of the International Ergonomics Association (IEA):

“Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being, and overall system performance.”

(This definition was adopted by the IEA Council in August 2000.)

Note the distinction made in this definition between the scientific discipline of ergonomics and the professional practice of ergonomics. Ergonomics scientists develop theories and conceptual frameworks, conduct empirical research to clarify relationships between key variables and establish reliable datasets, and so on – all with the general purpose of supporting and enhancing the professional practice of ergonomics. It is this intended application of their research that distinguishes ergonomics scientists from scientists in related domains.

The IEA subdivides ergonomics into three areas of particular expertise. According to its website, physical ergonomics is concerned with human anatomical, anthropometric, physiological and biomechanical characteristics as they relate to physical activity, and its applications include working postures, materials handling, repetitive movements, work-related musculoskeletal disorders (WMSDs), workplace layout, safety and health. Cognitive ergonomics is said to be about mental processes, such as perception, memory, reasoning, and motor response, as they affect interactions among humans and other elements of a system; its identified applications include mental workload, decision-making, skilled performance, human-computer interaction, human reliability, work-related stress, and training. Finally, organisational ergonomics is described as being about the optimisation of socio-technical systems, including their organizational structures, policies, and processes, and its applications include work and job design, design of working times (rest break regimes, shift rosters, overall working hours), teamwork, communication, participatory design, new work paradigms, virtual organizations and telework.

1 http://www.iea.cc/ergonomics/

2 In light of the large body of evidence now demonstrating the importance of affective or emotional aspects of people’s interactions with systems of various kinds, I suggest that the category of ‘cognitive’ ergonomics should be expanded to include these factors, and re-named as ‘psychological’ ergonomics.
Individual ergonomists are likely to develop varying levels of expertise across the physical, cognitive and organisational dimensions of ergonomics, depending on their particular interests and the application domain(s) within which they work. Nevertheless, it seems to me to be indefensible for an ergonomics practitioner who accepts the IEA view of ergonomics to confine his or her professional activities only to the physical aspects of a problem, or only to the cognitive or organisational ones; to focus so narrowly would be inconsistent with the broad, system-based approach that is a centrally important characteristic of ergonomics. An occupational biomechanist can legitimately take a purely physical approach, and an occupational psychologist can legitimately ignore many physical issues – but an ergonomist must have sufficient expertise to give adequate consideration to all dimensions of a situation. How else can s/he expect “to optimize human well-being, and overall system performance” in accord with the IEA definition? To draw a medical parallel, no practitioner could legitimately choose to deal only with the physiological dimensions of someone’s illness, while ignoring possible anatomical and psychological dimensions of the problem; such a doctor would not satisfy current standards of medical practice. Similarly, some degree of expertise across physical, cognitive and organisational dimensions is necessary for all ergonomics practitioners, because virtually all of the problems and situations with which they deal are potentially multidimensional in nature. For example, a client’s questions concerning the physical design of a piece of equipment can only be answered effectively if the purpose of its use, the specific activities that will be entailed in its use (encompassing perceptual, cognitive, affective and physical dimensions) and the physical and psychosocial contexts of its use, are all given adequate consideration.

Unfortunately, commonly held notions of ergonomics do not reflect the above view. Over the past few years I have noticed an increase in the number of people who recognize the word ‘ergonomics’ and believe they know what it means; however, a high proportion of these people believe that ‘ergonomics’ refers to quite a small set of purely physical issues. We are all familiar with advertisers referring to ergonomic chairs or other types of product, without any reference to their intended users or uses; and when ‘poor ergonomics’ is blamed for computer users’ discomfort or pain, we can safely assume that this refers only to poor design or adjustment of the users’ workstations. Depressingly, this narrow interpretation of ergonomics is common even among ergonomists, particularly in the USA. For example, a recent item on the Ergoweb list specifically excluded cognitive aspects of interface usability from the ‘ergonomic’ ones: The Ergonomics Report™ asked researcher-designer Susan Tuttle of Motorola ... whether ergonomics is an afterthought for the cell phone industry. She rejected the suggestion emphatically. "We ... at Motorola are constantly working to improve usability of our products, both from an ergonomic perspective, as well as from a cognitive perspective on the usability of the user interface ...”

HFESA requirements for admission to Certified Professional Ergonomist (CPE) status are in accord with the IEA’s multidimensional account of ergonomics. Attainment of CPE status requires completion of “an education program which provides a comprehensive set of ergonomics competencies”, including knowledge of the three main dimensions: “physical, cognitive, and organizational ergonomics”. Given this very wide breadth of required expertise, it is clear that no individual can hope to have an equally high level of expertise across the whole discipline. Further, the optimal ‘mix’ of knowledge across these dimensions will vary according to the particular application domain, which presents major challenges for those developing ergonomics curricula to satisfy requirements for professional practice.

2. Ergonomics, OHS and Other Application Domains

There are many possible ways of seeing the relationship between ergonomics and OHS. To ergonomists, OHS is one of the many domains within which ergonomists may practise, while to many OHS practitioners, ergonomics is simply one aspect of OHS. I developed Figure 1 to help me think about these inter-relationships. The two top layers of this figure depict the main sciences on which OHS practice is founded, with ‘pure’ sciences along the top and the more directly applicable, ‘applied’ sciences at the second level. It is there on the second level that I think ergonomics is best located – as a scientific discipline that exists to support ‘real world’ applications, but which exists independently of its various application domains.
Figure 1. Relationships between ergonomics and some of its application domains, with a focus on OHS. Tributary sciences for both ergonomics and OHS are included.
“It just makes good sense to implement ergonomic workstations that are easily adjustable.”

- Users can find the desk height that works best for them
- Added flexibility for different occupational tasks
- Sit or stand while working
- Improves employee retention, health, morale and satisfaction
- Dynamic, productive and healthier way to work
- Quick, effortless and easy adjustment regardless of the weight on the work surface
- Reduced absenteeism and employee turnover
- Increased productivity (employees can take “micro-breaks” without leaving their workstations)
- Reduced costs: Ergonomic programs can reduce workers compensation claims

electric height adjustable “sit/stand” desk

Alternating between sitting and standing positions is the most effective way to maintain productive workflow
As noted earlier, the IEA definition differentiates ergonomics scientists from ergonomics professional practitioners. Why, then, did I not include ‘ergonomics’ also in the third layer of Figure 1, along with other professional practice domains such as OHS and Road Safety? By this exclusion, I am suggesting that ergonomics expertise cannot be applied in isolation from domain-specific expertise, and that it is the latter kind of expertise that tends to predominate in determining an individual practitioner’s primary professional identity (although this is less likely to be so for members of ergonomics professional societies such as HFESA; we are a biased sample in this regard).

In the following section, I explore some reasons for the quite deep divisions among ergonomists along the boundaries between different application domains. I argue that when ergonomics science, principles and methods are integrated with those specific to a practice domain – whether OHS, road safety, HCI, or whatever – the nature of what we might now call ‘ergonomics’ practice necessarily varies substantially across domains, to a degree that results in many practitioners identifying themselves more strongly with the domain than with ergonomics.

3. The domain-specificity of ergonomics practice

There are at least two kinds of reason why ergonomists are so strongly aligned with different application domains. The first concerns the limited transferability of specific ergonomics constructs and methods between different practice domains; this is discussed in 3.1 below. The second relates to the motives shaping individual practitioners’ job choices and career development, which is discussed in 3.2.

3.1 Transferability of constructs and methods between application domains

The degree to which ergonomics expertise is transferable between domains is limited by the substantial variation in the nature of ergonomics practice, due to the very different nature of the systems with which ergonomists are dealing in these different domains. In the most general terms, the purpose of applying ergonomics is to improve system design – which might mean the design of: a piece of equipment; an information display; the activities that comprise a task; a job; a management system or specific components within it; a legislative system or specific components within it; and/or physical and psychosocial environments. Many systems have a great number of components interacting in extremely complex ways, and the criteria used to evaluate the quality of their functioning are variable: in some systems the primary focus is on safety of overall system functioning, in others it is on workforce health, or system productivity, or product usability, and so on.

Consequently, while the nature and quality of people’s interactions with systems is at the core of any ergonomist’s world-view, the precise meaning of this is highly variable. To illustrate this variability, I will focus on two of the key criteria affecting the quality of people’s interactions with systems – the demands with which they need to cope during their interactions with the system, and their resultant workload experienced in coping with these demands.

Professional ergonomists all understand the concepts of ‘demand’ and ‘workload’, and these concepts are potentially applicable to any kind of system within any application domain of ergonomics. In Table 1, I have outlined some details of several projects drawn from my own work experience, in which these concepts were applied in differing ways in different domains. As noted in the comments in the right-hand column, the transference of such concepts and related analysis and measurement methods between different applications often entailed their re-interpretation and modification. Details of some of the transference-related issues that arose during the projects summarised here will be illustrated and discussed during my oral presentation of this paper.
Table 1. Summary of some ergonomics projects that entailed analysis and measurement of demands and/or workload in different application domains, highlighting their similarities and differences.

<table>
<thead>
<tr>
<th>Era</th>
<th>Application Domain</th>
<th>Project outcome targets</th>
<th>Key system components</th>
<th>Comments re measurement of task demands, workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960s</td>
<td>• road traffic system</td>
<td>• crash risk</td>
<td>All elements of the road traffic system, including right-of-way laws, intersection design, traffic levels and complexity, travel speeds, vehicle characteristics, driver skills &amp; attitudes</td>
<td>• task demands identified and documented using domain-specific measures</td>
</tr>
<tr>
<td>1970s</td>
<td>• road traffic system</td>
<td>• road user mobility</td>
<td></td>
<td>• workload level assessed during or immediately post-performance, in accord with standard ergonomics techniques (secondary task, magnitude estimation, physiological indicators, driving performance measures)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• wellbeing not an issue</td>
</tr>
<tr>
<td>1980s</td>
<td>• workplace production system</td>
<td>• work rate standards</td>
<td>Task, materials, workstation, organisational &amp; industrial context</td>
<td>• critical task demands quantified using ergonomics science method (rarely possible)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• psychosocial context precluded quantification by ergonomics methods of task-specific workload, although this technically quite easy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• wellbeing not an issue</td>
</tr>
<tr>
<td>1990s</td>
<td>• workplace production system</td>
<td>• work rates</td>
<td>Production system, task, equipment, workstation, job, physical and psychosocial environments</td>
<td>• all relevant task demands quantified, using non-standard method</td>
</tr>
<tr>
<td></td>
<td>• OHS</td>
<td>• worker wellbeing</td>
<td></td>
<td>• workload quantified, but not immediately post-performance, and using non-standard method</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• wellbeing quantified using measures specific to that domain</td>
</tr>
<tr>
<td>1990s</td>
<td>• rail freight system</td>
<td>• staffing level</td>
<td>Control system tasks and equipment, job design and management methods</td>
<td>• a range of specific task and job demands analysed but not quantified;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• workload quantified using both modified and conventional ergonomics methods (modified NASA-TLX scales and magnitude estimation)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• wellbeing not a specific issue</td>
</tr>
<tr>
<td>2000s</td>
<td>• OHS</td>
<td>• worker wellbeing</td>
<td>All elements of workplace system, including task, job, physical &amp; psychosocial environments, &amp; worker</td>
<td>• comprehensive range of demands and environment factors quantified, using modified ergonomics and domain-specific measures</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• various dimensions of wellbeing quantified using domain-specific measures</td>
</tr>
</tbody>
</table>
The overall conclusion of my review of these specific projects is that ergonomics principles and conceptual frameworks are very widely applicable, but the specific ergonomics analysis and measurement methods that have been developed to support them are much more domain-specific. It is therefore far easier for practitioners to develop a high level of expertise if they confine their practice to a single application domain, or at least to a set of very similar applications. Over an extended period of time, this pattern of practice is bound to create many more domain-specific practitioners than generalists.

3.2 Development of professional identities and career choices

Available evidence suggests that the majority of people practising ergonomics choose to work mainly within just one application domain. This is certainly true of HFESA members, including CPEs, and presumably we are the least likely to follow this pattern, since we are members of this very ‘generalist’ society. What effect does a domain-specific work pattern have on the primary professional identity of such ergonomics practitioners?

One of the reasons why the nature of ergonomics practice varies substantially across different application domains, both in its content and methods, is that ergonomics concepts and techniques often need to be integrated with domain-specific ones in order to achieve maximum effectiveness. This necessarily entails close liaison with a variety of domain-specific professionals, and development by the ergonomist concerned of considerable domain-specific expertise.

I suggest that one outcome of this is that ergonomists who work within only one domain tend naturally to develop a stronger personal identification with the domain and their fellow practitioners there, than with ergonomics and ergonomists practising in other, quite different domains. I have experienced this myself, and have observed it in others. I attended the first meeting of the nascent Ergonomics Society of Australia (and New Zealand), and was a founding member of it. However, I worked exclusively within transport system safety, largely road safety, until the late 1980s, by which point I was on the brink of leaving the Society because during the 1980s its expanding membership had become largely focused on OHS applications whereas I was concerned with road safety, which was about very different issues. I remained a member only because at that point I became an academic and so had to broaden my expertise and practice activities beyond those related to transport systems. Many ergonomists, however, probably have no particular reason to expand their ergonomics expertise beyond a single application domain. The importance to such people of ‘ergonomics’ as a source of professional identity, relative to the importance of their particular practice domain, seems likely to weaken over time.

In this context, the self-perceived professional identity of CHISIG members within HFESA is an interesting question. CHISIG is a subgroup of HFESA, and its members include ergonomists with an interest in CHI as well as computer professionals with an interest in ‘human factors’. However, it seems (based on informal reports of recent discussions within CHISIG), that relatively few CHISIG members are interested in developing a primary professional identity as an ergonomist. Consistent with this, in past years when the CHISIG and HFESA conferences were held in the same city and the same week, few people attended both, and I imagine that the same pattern will hold this year in Canberra. This separation makes it possible that CHISIG might in future decide to break its existing formal ties with HFESA, assuming that its own membership is ‘healthy’; in fact, comparison of the published programs for this year’s HFESA and CHISIG conferences suggests that CHISIG may currently be the more ‘vibrant’ group. I attribute this not to any less enthusiasm and efficiency on the part of HFESA conference organizers. Rather, I think it is probably because many more people have both the ability and the motivation to involve themselves actively in domain-specific professional activities (such as the CHISIG conference) because these are more relevant to their ongoing workplace activities than more general HFESA activities (such as the HFESA conference).

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The same kind of pattern can be seen in the domain of road safety – although in a more extreme form since the current large and thriving group of Australian road safety researchers and practitioners no longer has any association with HFESA – despite the fact that when road safety research commenced in Australia, everyone who was then active in the area was a member of the newly formed Ergonomics Society of Australia and New Zealand. This society was one of the key organizations promoting road safety, with great success; in the first decades of our Society, every conference had a significant number of road safety-oriented presentations, and both practitioners and researchers in this domain were members of the Society. Nowadays, road safety people run their own annual conference (a considerably larger one than the HFESA conference), and very few people from that domain are still active within HFESA, or even remain as members. They certainly do not usually attend our conferences, unless asked to present papers. In my

own case, I work across more than one domain but I still usually opt to attend domain-specific conferences that focus more specifically on my own particular interests than is usually (and quite properly) the case with HFESA conferences.

3.3 On hydras and HFESA

In the above two sections I argued that the current, largely domain-specific pattern of ergonomics practice is very likely to continue. In the remaining sections, I will argue that this is not necessarily problematic, even if some ergonomists eventually lose touch with HFESA. Rather, professional bodies such as HFESA need to accept and utilize this characteristic of ergonomics practice, since it has the potential to be an effective means of accelerating the implementation of ergonomics more widely throughout our community.

Figure 2. Photograph of a hydra with a young bud that is nearly ready to break away from its parent and live independently. See http://cas.bellarmine.edu/tietjen/images/cnidarians.htm for more details on the exciting sex life of the hydra and other cnidarians.

In thinking about these issues during the process of writing this paper, I found myself visualising “ergonomics” as a hydra-like animal undergoing asexual reproduction (see Figure 2). In following this metaphor further, I was amused to find it quite a useful way of extending my thinking about ergonomists’ employment patterns. So … I ask you to do the same: imagine HFESA as a hydra-like professional body that is always growing new ‘buds’ (associated with particular application domains), that initially remain part of the parent animal but eventually break away and become separate animals. This development and break-away process can be seen as analogous to the development within HFESA and eventual independent maturation of road safety researchers and practitioners.

HFESA’s very large CHISIG ‘bud’ is still formally attached to its parent, and hopefully it will remain so. However, I don’t think it would surprise anyone if it followed the road safety people and established itself independently of HFESA. If this were to happen, perhaps HFESA should celebrate its parental success (jointly with the other parents who created CHISIG), and be pleased that its ‘child’ had grown and developed sufficiently to ‘leave home’, since its independent viability would demonstrate the major extent to which ergonomics was being integrated and implemented within that domain.

4. Being an ergonomist versus doing some ergonomics

For the reasons outlined above, it seems likely that domain-specific ergonomists will continue to outnumber generalist practitioners – not least because they will usually be more expert and effective within their domain than other ergonomists, and because of this their services are likely to be in greatest demand. In most domains, these ergonomists will be working alongside other people who have some expertise in those aspects of ergonomics that are most relevant in that situation, but who are not ergonomists in the full IEA sense. In this context, I think it is important that we more clearly distinguish the professional practice of ergonomics by ergonomists, from the application by non-ergonomists of just some aspects of ergonomics to some kinds of problem.

\[ In \text{ case some of you think of hydras as multi-headed mythical monsters, I should say that I am thinking here of the microscopic little animals that live in ponds, studied by zoology students such as I once was. These hydras are in no way monstrous – see Figure 2, which is a photograph of a hydra. \]
Within the domain of OHS, I believe that the widespread failure to clarify this distinction has contributed to the present unfortunate situation, discussed in section 1, in which ergonomics is widely understood as a quite narrow, specialist area within OHS. For example, many people – including some OHS practitioners and the US Congress – think in terms of “ergonomic hazards” or even “ergonomic injuries” (meaning musculoskeletal disorders). This kind of terminology should set any real ergonomist’s teeth on edge, since it implies that ‘ergonomics’ is primarily about the prevention of physical hazards that affect the risk of musculoskeletal disorders (MSDs). Ergonomists do indeed have a great deal to contribute to the effective management of MSDs (sometimes called ‘ergonomic injuries’), including the management of organisational and psychological MSD hazards – not just physical ones. Whether or not OHS professionals more generally should be similarly capable of managing MSD risk is one of the issues that needs to be resolved jointly by these two professional groups.

Terminology that equates ‘ergonomics’ with MSDs and workstation design problems seems to stem from non-ergonomist OHS practitioners who know about and apply some aspects of ergonomics, without any understanding of the larger picture. I fully support non-ergonomists ‘doing ergonomics’, but we should not confuse this with the work of professional ergonomists.

5. What should HFESA do?

In the preceding sections, a variety of issues have been identified that present significant challenges to professional societies such as HFESA. To deal most effectively with these, it seems to me essential for HFESA to identify two key goals, which are conceptually separate, although closely and synergistically linked.

I propose that the first, and arguably most important goal of HFESA should be to promote ergonomics – particularly its more widespread and effective implementation. This seems to me to be a pre-requisite for success in pursuing a second important goal – promotion of the quality of ergonomists’ professional practice.

5.1 Promoting ergonomics – particularly its wider and more effective implementation

Back in the 1960s I was fortunate enough to be working with Ron Cumming, after whom this lecture is named, and to be involved in the establishment of HFESA’s early predecessor – the Ergonomics Society of Australia and New Zealand. Ron was a major driving force in its establishment, along with people like John Lane, Alan Welford, Ken Provins and Ross Day. As I remember things, their main motive (if not the only one) was promotion of the more widespread implementation of ergonomics. In more recent decades, there seems to have been increasing focus on promoting the perceived needs of members, and relatively less focus on promoting ergonomics as a discipline. Within a world that is changing as rapidly and radically as ours, a focus that is too narrow and inward-looking threatens the Society’s future viability. I suggest that unless HFESA makes achievement of this first goal its primary objective, ergonomics in Australia is likely to become increasingly submerged within its largest local application domain, OHS, so that ‘what ergonomists do’ will grow ever closer to the present, very narrow popular image of ergonomics rather than developing as the broad, systems-based discipline envisaged by the International Ergonomics Association.

There are many different strategies that might be effective in promoting ergonomics, and it’s beyond my role or ability here to provide a comprehensive catalogue of them. The following are just some initial ideas.
a. More clearly differentiate ‘ergonomists’ from other practitioners within application domains

In supporting and promoting the implementation of ergonomics in different ways across different domains, it is important that we clearly differentiate ‘ergonomists’ in the IEA sense, from other professionals within those domains – many of whom may well be ‘doing ergonomics’ in some more limited way. The risk otherwise is that ergonomics itself becomes identified with a much narrower set of activities, to a degree that threatens the future viability of ‘ergonomics’ in the full sense. I see this as a centrally important and primary responsibility of HFESA, although further development of our membership grades and criteria might be needed to achieve this, which is a daunting prospect for those of us who have suffered through past debates on this subject.

Achievement of this goal will require HFESA’s engagement in the development of an educational infrastructure that can produce new generations of professional ergonomists, as well as non-ergonomists who are equipped to implement those aspects of ergonomics that are most relevant to their particular domain (see subsection c below). I think that it is only during the process of tackling these difficult but necessary activities at an operational level that we will be able to define acceptable ways of differentiating professional ergonomists in the full IEA sense, from people who are able to implement ergonomics knowledge and principles within a more limited set of situations. Further, this task can only be done in a sustainable and effective manner if we work cooperatively with practitioners within the main application domains of ergonomics.

b. Develop closer, supportive relationships with application domain practitioners

In section 3 I likened HFESA to a hydra, in that both can reproduce by ‘budding’. Perhaps some of you spotted a flaw in my hydra metaphor when I referred to CHISIG’s other parents, since the hydra reproduction process depicted in Figure 1 is asexual (i.e. it involves only one parent and results in baby hydrams that are the same as their parent). CHISIG is certainly not the same as HFESA, and HFESA is never the only parent in these cases – there is usually at least one application domain that is also playing a parental role, so we’re really talking about sexual reproduction. Let’s assume that HFESA is the mother, so in that case there could be an assortment of fathers, each of whom is a different type of APDOM (Application Domain). A bud develops on HFESA at the point where she is inseminated by an attractive APDOM ... and often without any form of family planning on HFESA’s part! I suggest that HFESA needs to be more strategic in its approach to this activity – to get out there and pro-actively target the more attractive APDOMs with the deliberate intent of ‘making babies’. Imagine the possibilities! And if we enter more pro-actively and thoughtfully into this process, we’ll probably have a greater chance of continuing to be on speaking terms with our children, even after they’ve grown up and established themselves as self-sustaining areas of practice.

In other words, I’m suggesting that one of HFESA’s most important future roles should be to identify and nurture nascent ‘interest groups’ within targeted application domains, with the aim of enhancing the ability of people within these groups (e.g. OHS practitioners; human resource managers; industrial designers; etc) to implement ergonomics within their own work. By such means, with continuing support from HFESA, ergonomics could become much more effectively integrated within the normal practice of the domains involved, thereby embedding ‘ergonomics’ (without necessarily labeling it as that) as part of the domain’s inherent fabric. Another possible way of achieving this objective might be via the development of additional domain-specific SIGs (such as CHISIG) within HFESA; for example, community safety practitioners might well be interested in such an arrangement. In general, the application domains targeted for ergonomics infiltration and support should be those where there is significant potential for much greater implementation of ergonomics than is currently occurring (greater in quality as well as quantity).

In Australia, OHS is currently recognized as an important ergonomics application domain, but there is great scope, and need, to find better ways of supporting and promoting the implementation of ergonomics in its full sense within OHS. Since many of HFESA’s current members are primarily OHS practitioners, and quite a few hold influential positions within government, we are well placed to take on this role. In doing this, I think we should look at the advantages to be gained by collaborating much more closely with the Safety Institute of Australia, which is usually seen as Australia’s leading OHS-oriented professional society, and is certainly much larger than HFESA. In fact quite a few HFESA members are also SIA members – myself included. A useful platform for initiating such a process might be COSHAP – the Congress of Safety and Health Association Presidents, which includes HFESA along with the SIA, the Australian College of Occupational Health Nurses, the Australasian Faculty of Occupational Medicine, and the Australian Institute of Occupational Hygienists. The aims of COSHAP include the facilitation of communication and cooperation between OHS professional groups; the representation of the interests of OHS professionals on relevant industry and government committees; and the provision of a

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focus for the enhancement of the contribution of OHS professionals within the National OHS Improvement Framework and National OHS Strategy. All of these seem to me to be very worthwhile aims for OHS-oriented ergonomists. In fact, if it is potentially achievable, my own view is that we should stop trying to maintain multiple OHS-oriented Societies and instead, create a new ‘umbrella’ body within which there are special interest groups (SIGs) representing all of the specialist areas of COSHAP partners. Less ambitiously, we could certainly contemplate forming an OHS SIG within HFESA, to more clearly differentiate ergonomics from OHS in the minds of non-ergonomists.

**c. Enhance ergonomics knowledge and skill development among non-ergonomists**

HFESA should work with interested professionals within the major application domains of ergonomics to identify their ergonomics competency requirements. Most do not aspire to be ergonomists but would nonetheless be interested in learning about those aspects of ergonomics that would be most useful to them. Since these non-ergonomists will always outnumber ergonomists, it seems to me that HFESA should support them in ways that will maximise their potential to support and enhance the future of ergonomics.

I suggest that HFESA should work with domain-specific practitioners to conduct training needs analyses and on that basis to improve ergonomics content within relevant education and training programs, including the development of new modules, or even whole courses, where required. There are various strategies by which this objective could be pursued, including support for web-based and other teaching resources at a range of sub-professional and professional levels.

To underpin such activities HFESA needs to develop a broad blueprint for ergonomics education and training, addressing the needs of non-ergonomists as well as those of professional ergonomists in a coherent way. (see 5.2).

**d. Support the development of ergonomics-related content within domain-specific legislation, codes of practice, guidance and procedural documentation**

One of the ways in which ergonomics is implemented by ergonomists is via legislation and related guidance documents, as depicted in Figure 1. Some individual ergonomists have made important contributions to these tasks, but the more proactive and formal involvement of HFESA has the potential to provide added value. In particular, HFESA could work to improve the match between the level of ergonomics information contained in guidance documents (by input into their development), and the likely level of ergonomics ‘literacy’ among their non-ergonomist users (by input into their training courses, as suggested in subsection c above. Currently, there are quite a few examples of guidance documents whose effective use demands a level of ergonomics competency that would far exceed that of most users.

**e. Other strategies to promote ergonomics**

I’m sure that there are many other ways of promoting ergonomics. My own suggestions are that HFESA should promote the ongoing development of ergonomics science by providing some formal support for research students, and by lobbying research funding bodies to increase their awareness of ergonomics research needs. In addition, I suggest that HFESA should support the more widespread implementation of ergonomics by helping to organise and to publicise results from demonstration projects in which multiple types of both human and economic costs and benefits are documented, to evaluate the effectiveness and benefit/cost ratios achievable by ‘good ergonomics’.

**5.2 Promoting the quality of ergonomists’ professional practice**

As discussed in earlier sections, the professional practice of ergonomics must incorporate adequate consideration of physical, cognitive and organisational issues. In the past, when no formal training in ergonomics was available in Australia, we tried to overcome our lack of across-the-board expertise by working in teams that, as a group, covered all bases. The team shared a common knowledge and understanding of the principles of ergonomics, and usually we had enough time and other resources to be able to work together in a coordinated way that supported application of our joint expertise. The deficiencies in our expertise at an individual level were therefore much less problematic than in today’s ‘downsized’ and time-pressured workforces, where both time and multidisciplinary teamwork have become luxuries and there is a consequently greater need for each individual practitioner to have broad expertise covering all aspects of ergonomics.

There is also an important need for professional ergonomists to have substantial expertise related to the application domain within which they mainly practise. Their expertise should encompass the particular ergonomics analysis and measurement methods that have been developed for use within that domain, as well as contextual information such as specific legislative requirements. This poses many questions for ergonomics educators who are aiming to produce
graduates satisfying CPE or other such educational requirements for professional practice. How, and to what extent, should we expect the competencies of ergonomists who practise mainly within one particular domain to differ from those of ergonomists practising in a quite different domain? Is it feasible for a single educational program to meet the needs of graduates who will be going on to practise in quite different domains? In my experience, it is neither realistic, nor of much practical value, to teach ‘ergonomics’ independently of the competency requirements of particular application domains; but how far should we go in tailoring courses to meet domain-specific needs?

A major challenge, then, for those assessing the credentials of CPE applicants, and also for ergonomics educators, is to define the required minimum depth of expertise that an ergonomist should have across the very broad range of ergonomics competencies, encompassing physical, cognitive and organizational dimensions. The ESA/NZEA Competency-based Standards project, completed in 1997, produced a statement of core ergonomics competencies, but as an ergonomics educator I think that it is too vaguely worded to provide an adequate basis for evaluating the credentials of CPE applicants, or to evaluate ergonomics courses for the purposes of course accreditation.

The professional bodies of doctors, lawyers, engineers, psychologists, occupational therapists, physiotherapists, and so on are all actively involved in accrediting university courses in order to maintain appropriate professional standards among their members, and I suggest that HFESA should go down this path also. However, for this process to be worthwhile, we need to develop answers to some of the questions posed above, and to consider also the kind of differences that are appropriate between courses at different levels – including graduate and postgraduate courses such as Masters degrees and postgraduate diplomas, Bachelors degrees, and lower level courses that are intended for much more specific purposes.

In addition, it will be necessary to undertake the complementary task of ensuring that CPE educational criteria are consistent with these educational standards, that they are appropriate in both breadth and depth for ergonomists practising in a variety of different domains, and that CPE accreditation procedures are applied are valid, reliable, and equitable.

In summary, I suggest that HFESA should promote ergonomics via a coordinated set of strategies encompassing all of the above approaches, to achieve: (1) more widespread implementation of ergonomics – by whomever (ergonomists and non-ergonomists), labelled as whatever (not necessarily ‘ergonomics’); and (2) ongoing development of ergonomists’ professional practice standards. I believe that we need to pursue both of these goals if we are to ensure a future for ergonomics, and that this will require HFESA to develop closer and more supportive relationships with non-ergonomist practitioners within the main application domains of ergonomics.

I look forward now to hearing other people’s views on the issues that I’ve raised.

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Wendy has produced well over 100 publications on safety and health issues, including many international and national conference presentations. She has particular expertise in relationships between psychological hazards, workload (including the role of work rates and staffing levels), stress, musculoskeletal disorders and other aspects of employee wellbeing. Some of her recent work on this topic appears in the forthcoming new edition of the International Encyclopedia of Ergonomics and Human Factors.

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WORLD CLASS: BE PART OF IT
What an Ergonomist needs to know about room acoustics

David Brown

Every day, we are faced with problems of understanding what we hear. The announcement at the railway station, loud but unintelligible; your dinner companion in the noisy restaurant, saying something that might be important if only you could figure it out... is she breaking up with you, or does she just want the salt?

Computers have similar problems. Recently my Dragon voice recognition software was running perfectly, until there was an almost inaudible hum as the neighbour’s air conditioning turned on, and suddenly the words all came out gibberish. I ran Dragon’s spectrum analyser and I saw that a low frequency rumble that I was hardly hearing was totally upsetting the program.

Computer voice recognition is only recently in common use, but the intelligibility problem has been studied for a long time, and the solutions are well known:

“Long practice with speech intelligibility measurements with a standardised (recorded) speaker has shown that the articulation loss of consonants has to be less than about 15% to represent good listening conditions” – W. Klein, 1971

There are new measures of intelligibility since then, but Klein’s conclusions remain valid. He said that poor intelligibility is due to one or more of three related factors:

1. background noise level may be too high (i.e. signal to noise ratio is too low);
2. reverberation time may be too long; or
3. distance from source to listener may be too large relative to the critical distance.

**Signal to noise ratio**

Unless we get a signal that is a lot stronger than the noise (e.g. the voice has to be well above the restaurant clatter), some people won’t understand everything being said. ISO 7731 defines 15 dBA as the minimum signal to noise ratio so that everyone with reasonable hearing can hear a spoken alarm message.

So is that achievable? A U.S. survey found that noise levels recorded in five restaurants were between from 50 dBA in an elegant restaurant to 90 dBA in the noisiest one tested, averaged over a one-hour period [http://www.ucsf.edu/audio/restaurantnoise.html](http://www.ucsf.edu/audio/restaurantnoise.html). It means that to meet ISO 7731 in the noisiest restaurant you would need to shout into your partner’s ear at 105 dBA just to ensure they knew there was a fire! So if you want to whisper sweet nothings, your only option is to complain about the noise (you should always complain or nothing will change) and then choose a quieter restaurant.

That ISO 7713-specified 15 dBA signal to noise ratio will ensure that nearly everyone can understand a warning message, but in reality it’s 10 dB short of the optimum figure for general conversation. Dragon’s acoustic analyser will tell you that it needs more than 15 dB signal to noise ratio, and in my experience the program performs much better as you approach 25 dB. Similarly Klein (1971) referred to a 25 dB figure as the target for voice intelligibility, and the experiments of Peutz (1971) also showed that 25 dB is the signal to noise figure at which understanding plateaux.

You can understand a 25 dB difference very well, but that still doesn’t make it ideal for a relaxed conversation. A telephone line is meant to have a signal to noise ratio of 45 dBA or better, otherwise it’s considered too noisy and they send the repair man to fix it. Constant hiss or mumbled voices in the background might not stop you understanding the person you’re listening to but it’s tiring and annoying, in fact noise raises your blood pressure!

**Reverberation**

“Churches of medium size frequently are satisfactory for music but are marginal or unsatisfactory for speech. Usually the congregation will try to solve matters in one of two ways: a public address system (which, chances are, merely will increase the level of chaos) or sound absorption treatment (which may spoil the church for music).”(Journal of the Audio Engineering Society of America, July 1960.)

Reverberation is important for music, otherwise it sounds too thin, but it is a problem for intelligibility of voices because reverberation is, basically, echo soup.

The more delayed the echoes are, and the stronger they are, the more the soup interferes with understanding. **Reverberation time** isn’t exactly either of those, but it’s related and it is the easy way to measure the soup. It is defined as the time it takes reverberation to decay to -60 dB (i.e. to one millionth) of the original sound level.
The best intelligibility occurs in a room with a very short reverberation time of 0.2 seconds, or even less. Sound decays exponentially, so at one third of the reverberation time the sound is at a level ~25 dB from the starting point, which as we saw above is a sort of magic figure for signal to noise ratio. In a room with 0.2 seconds reverberation time, the echoes have died down below ~25 dB in about 66 milliseconds. This is consistent with experiments by Haas in 1949 (which defined “the Haas effect”) on deliberate introduction of echoes. He show that 50% of people feel disturbed if an echo arrives 68 milliseconds after a word; shorter is better, longer is worse.

Reverberation time can be reduced by carpets, wall hangings, ceiling tiles. All of these absorb sound as it bounces back and forth, with the result that the echoes subside more quickly.

Different reverberation times are acceptable for different purposes:

- Speech recording studios have very little reverberation.
- Classrooms with an unoccupied reverberation time of less than 0.5 seconds will still have good intelligibility because people and clothing absorb some sound, so reverberation time will be shorter when the room is full.
- Halls typically have a need for some music and some voice. The “rule of thumb” for a hall is that reverberation time should be less than 1.5 seconds in order for voices to be highly intelligible.
- Purely orchestral halls can have a longer reverberation, 2 seconds is an often quoted figure but Notre Dame has an 8 second reverberation time. Very good for organ music and choral chants.

Of course our criterion for “highly intelligible” in a hall or a church is nothing like as high as we want for a classroom.

Critical distance

As well as the reverberation time, the intensity of the reverberant sound compared to the intensity of the direct sound is important and the easiest way to control that is to move closer. But how close?

When you’re close to the speaker (or the loudspeaker) you understand them well, whereas the further you move from the speaker, the less intelligible they are to you, because the reverberant sound becomes as loud as the direct sound. But there is a distance at which intelligibility stops getting worse (if the volume remains high enough) and everyone past that point is equally badly off. Fascinatingly there’s a simple formula for the understandability of consonants (vowels don’t matter):

**Critical distance = 0.2 x sqrt (Room volume / reverberation time)**

Another definition of critical distance is that it is the distance at which the direct sound is 10 dB below the reverberant sound. So if you’re beyond the critical distance all you’re responding to is reverberant sound and really nothing else. If the reverberation time is less than 1.5 seconds you can probably still understand some of what’s being said, but if the reverberation time is more than that you’re unlikely to understand anything, and you only option is to move closer.

You can improve (i.e. increase) the critical distance by making the loudspeaker more directional, so that the listener gets more of the direct beam and less sound energy goes into reverberation. If you can’t do anything to the room, move everyone closer to the speaker – get everyone nearer than the critical distance and you’ve got a chance at least that the speaker will be understood.

Deliberately reducing intelligibility

The sound of other voices is far more annoying, intrusive and distracting than air conditioner noise, for instance. That, and privacy issues, have led many workplaces to introduce white noise to mask conversations, but the noise level required can be high enough to cause new problems. So a range of sound absorbing, blocking and deflecting panels might be installed in your open plan office.

However a hearing impaired person on the other end of your phone can wipe out all the benefits for your office neighbours. I’ve been in the room often when the call centre operator is shouting into their phone or headset so the near-deaf person can hear. The noise is very disruptive to other workers. Better phones are needed, but they are very hard to get!

It’s remarkable how tweaking the frequency response with a “tone control” or equaliser can help. It’s also amazing that in a call centre operators aren’t given any frequency response controls and aren’t given any control over the outgoing volume. They need both those things in order to deal with our increasingly aging population.
Turning a deaf ear to the annoyances of the young

Back in the 80s, 20-year-olds were complaining about VDU’s making high pitched sounds. I assessed some of these people, whose supervisors thought them neurotic because the supervisor couldn’t hear a thing and decided that the person must have tinnitus. It turned out that they were using computer screens that scanned the horizontal lines of the CRT at 15 kHz, which is well within the hearing of a young person and well above what the 50-year-old supervisor could hear. This sort of thing became a theme of the times, with supervisors poo-poohing all sorts of things that turned out to be true after all, once you had a really good look.

Now the baby boomer generation are the supervisors—veterans of rock concerts and motorbike riding. Many can’t hear anything much above 5 kHz. And the Ipod generation is following on behind …

Sorry, did you say something?

References


About the author:

David Brown, B.Sc. M.A. is a workplace psychologist and ergonomics consultant. He once designed and built loudspeaker systems and specialised hearing aids.
Reviews of Human Factors and Ergonomics, Volume 1

Edited by Raymond S. Nickerson

The new HFES annual series, *Reviews of Human Factors and Ergonomics*, condenses human factors/ergonomics knowledge in specific subject areas into a form that provides readers with a comprehensive understanding of each topic – its current state, important new research findings and technology, and current issues and research needs.

Each volume of *Reviews of Human Factors and Ergonomics* focuses on findings that are applicable in real-world contexts, especially to the design of devices, systems, or processes that people use or with which they interact. The chapters note ways in which research results inform theory or methodology for future research and also emphasize the practical implications of the research that is reviewed. Accordingly, in Volume I, three chapters focus on research areas:

**Biomechanical Modeling**
by William S. Marras & Robert G. Radwin

**Human-Automation Interaction**
by Thomas B. Sheridan & Raja Parasuraman

**Technology and Aging**
by Wendy A. Rogers, Aideen J. Stronge, &
Arthur D. Fisk

and three emphasize areas of application:

**Driving Safety**
by John D. Lee

**Improving Product Safety and Effectiveness in the Home**
by Deborah A. Boehm-Davis

**Reducing and Mitigating Human Error in Medicine**
by Daniel Morrow, Robert North, &
Christopher D. Wickens


**Forum**

**Productivity Commission of Inquiry into Standards Australia and NATA, 2006**

Members who follow aus_ergo will be aware that this Commission has invited submissions from interested organizations and individuals. The item seemed to arouse little interest among ergonomists, in spite of the matters being of some significance. There have been considerable changes in recent years relating to the activities of Standards Australia and these have had, and will continue to have, a considerable impact on its operations. Standards Australia has advised members of its own submission which is available at the government site, along with others received there. The link is:  

HFESA has a number of representatives on various Standards Australia committees who give their time voluntarily to the discussion and formulation of related standards and guidelines. Traditionally, committee members have included delegates from government departments and industry and professional associations. There has always been a strong commercial/supplier presence that has attempted to moderate outcomes. In recent years the make-up of committees has tended to be affected by the closure of the old Commonwealth Department of Housing & Construction and the State Public Works Department in NSW, along with a significant reduction is the number of government departments and large consultancy representatives. This has been attributed in general to an increasingly tight business economy; several people have voiced concern about the unfair burden currently being placed on sole practitioners who are left to shoulder the professional societies’ representation in these difficult times. The submissions currently online indicate a much deeper concern about the personal effort, time and financial commitment of the volunteer committee members, in view of the new commercial links of Standards Australia with SAI Global, which are affecting the production of Australian Standards and linkages with NATA laboratory certification.

Ergonomists generally may not be aware of recent developments. In 2003 the restructure of Standards Australia (a non-profit organization) introduced a commercial arm, SAI Global, to augment the former entity’s government subsidy. This was explained as being necessary to extend and improve services for staff and the 8200 volunteers on 1575 technical committees. SAI Global now plays a pivotal role as a certification body in the standards and conformance infrastructure. Its main objectives involve the commercialization of Intellectual Property developed and licensed by Standards Australia as follows:  


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<th>Business publishing</th>
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<td>Compliance services</td>
<td>Develops compliance regulatory awareness solutions</td>
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<tr>
<td>Professional services</td>
<td>Enhance through training and consulting services</td>
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<tr>
<td>Assurance services</td>
<td>Provide assurance through conformity assessment and certification</td>
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In 2005, Standards Australia sold 90.3% of its shares and conceded exclusive rights to a business unit in SAI Global: Business Publishing, to publish and distribute Australian Standards in Australia and the right to publish and distribute Australian Standards globally. As reported in SAI Global 2004–2005 Annual Report, Business Publishing currently relies on Standards Australia for the provision and supply of revenue generating Standards. This arrangement means that the Board of SAI Global needs to maximize profits for its shareholders and in doing so exerts major commercial pressure on the “not for profit” Standards Australia to produce as many new and revised standards as possible. In so doing the marketing arm of SAI Global concentrates on new and revised standards that produce a profit when published—even if only in the short term. Concern has been expressed that most of these standards suit lawyers, accountants, salespeople, and governance interests while the hard sciences and engineering standards are not given a high priority.

Standards Australia currently owns only 9.7% of shares in SAI Global. Most committee members have been happy to contribute their intellectual property, unpaid time, absence from their own work, and related travel/accommodation expenses on behalf of a non-profit organization—as a professional responsibility for community benefit. There has been a sudden awareness that the volunteers, giving their time and intellectual property freely to a not-for-profit Standards Australia, and are now being used to generate profits for its commercial arm, SAI Global Limited. Interested members should investigate submissions to the Productivity Commission of Inquiry on the web link provided in this Forum.

**Shann Gibbs**
**Noticeboard**

1. **IEA 2006 to exceed expectations!**

On April 1st there were one hundred days to go for the 16th World Congress on Ergonomics. Now we are sure that the program is at its full extent: about 1,000 oral presentations, 25 interactive sessions (workshops, round table, hands on sessions) and more than 250 posters. The number of people who have registered grows quickly and is now already over 1,100. We expect some fifteen hundred participants, so it will be a large congress, but not too large.

During the congress week, from 9-14 July, the congress venue, the Maastricht Exhibition and Congress Center, is exclusively available for IEA2006. All sessions will be held in the center, under one roof.

*Ernst A.P. Koningsveld*  
IEA2006 Congress Chair  
[www.iea2006.org](http://www.iea2006.org)

2. **IEA Logo Contest**

The IEA 2006 Congress in Maastricht, Netherlands in July will be an opportunity to celebrate the 50th anniversary of the decision to found the IEA. A number of events will be organized during the Congress for that purpose.

One of these events will be a contest for designing a new IEA logo. This message is a call for submissions for this contest. This call for submissions, together with the attached document describing the rules of the IEA Logo Contest, is under the responsibility of IEA Federated Societies. It should be distributed as widely as possible within your society.

Electronic submissions should be sent to the IEA Secretary General no later than June 1, 2006. The final choice of a logo will be taken by popular ballot of all attendees at the IEA 2006 Congress. The winner will be awarded a prize of US$500, and his/her name and photo will be posted on the IEA website for the next year.

*Pierre Falzon*  
President of the IEA

PS to HFESA members ... For the current IEA logo and other IEA information, go to: [http://www.iea.cc/](http://www.iea.cc/)

The contest is open to ANYONE: ergonomist, daughter, son, wife, husband, neighbour, etc. The goal is to have the best possible logo. The prize is symbolic. The main interest for the contestant is to gain some “official” recognition.

So, get your pen working!  
Again, all the best,

*Pierre Falzon, President of the IEA*

3. **Ergo Future 2006 International Symposium on past, present and future ergonomics, occupational safety and health.**

**Ergonomics challenges for safety and healthy organization of work.**

**Background**

Based on long experience of working in this field, we are still practically running on the same spot while accidents happen in spite of regulations, well-equipped workplaces and personal protective devices. There are huge gaps in the research and application of ergonomics in the workplace and there needs to be a total approach to developing safety behaviours and mind sets in order to solve complex problems. It seems that research has been running on the same spot, using a recall of what has been done previously, and repeating the same things with different people and different methods as well as technology—with little evidence of any real problem solving.

**Goals**

To provide guidance and direction for young ergonomists and occupational health workers while identifying unfit, improper and inappropriate research and application in these fields.

To determine a total and more strategic approach that will demonstrate the need for a change of mind set about unsafe behaviour in order to achieve the desired results.

**Method**

Listing evidence of genuine problems and convincing people of the need to achieve these goals by demonstrating that such an approach is necessary and achievable by elaborating and disseminating information about sustainable outcomes.

The symposium will bring together key personnel to discuss future directions for this approach and invites researchers, industrial managers, unions, government representatives, academics and students to attend.

**Venue**

The new building of the Udayana University—School of Medicine of which the last part is still in process of development although it is fully valid to be used as an international symposium venue, especially in relation to its high-tech deliberation facilities.
Human Factors/Ergonomics spans the full range of interactions between people and the systems, spaces and designs that they encounter. Our research and practice need to engage with developments in overarching policy and legislative frameworks, organizational design and management, physical environments, products and devices. The Theme of this year’s conference seeks to identify current developments at these various ‘scales’ of concern and to explore the related challenges and opportunities for those working in our field.

The conference will provide a forum for people across the spectrum of Human Factors, Ergonomics and Management interests to exchange ideas and identify new opportunities and challenges in the field. The conference will be of interest to Human Factors and Ergonomics professionals, Management professionals, Design professionals (including Architects, Engineers, Industrial Designers, and Interface/Interaction Designers), OHS and injury management professionals, Psychologists, Occupational Therapists, Physiotherapists and those working in related academic disciplines.

(Nota: The 2006 Conference will also be held back-to-back with OZCHI—the annual conference of the Human Computer Interaction Special Interest Group of the HFESA. A separate call for papers for the OZCHI Conference will be published.)

The Human Factors and Ergonomics Society of Australia (HFESA) and the NSW Organizing Committee take great pleasure in inviting submissions for presentation to 42nd Annual Conference of the HFESA. We encourage you to give a paper, poster or workshop at the conference. We plan to address themes in Human Factors and Ergonomics which deal with systems, spaces and designs for people in contemporary settings related to work, home and leisure.

Paper Presentations

30 minute timeslots have been scheduled for short paper presentations relevant to the conference theme (20 minutes presentation followed by questions/discussion.)

Workshops

A program of 90 minute workshops has been planned to allow participants to gain practical experience with new ideas, tools ans strategies that they can apply in the field.
Poster Presentations
Poster presentation will provide the opportunity to display information about projects and outcomes. Posters will be on display for the duration of the Conference. Provision will be made for poster presenters to discuss their work with conference delegates.

Closing dates for submissions
Paper abstracts and workshop proposals:
Friday 21 April 2006

Proposals for poster presentations:
Friday 30 June 2006

If you have any questions about the content or format of your proposal presentation please contact Jonathan Talbot by email: j.talbot@unsw.edu.au or phone the conference secretariat: Tel: 612 4422 2214

Selection of papers
Abstracts will be subject to a peer review process and we plan to advise authors regarding their submission by Friday 12 May 2006. The decision to accept a paper is at the discretion of the Organizing Committee. A condition of acceptance of a paper is that at least one author or nominated presenter registers for the Conference.

If your abstract is accepted, you will be asked to submit a full draft paper for review. The deadline for the full draft paper is Friday 16 June 2006. You will be notified of final acceptance of your paper subject to satisfactory editing in the light of referee’s comments. A final edited version will be required by Friday 15 September 2006.

Review criteria will include relevance, originality of ideas, and significance of results, accuracy and quality of presentation. Accepted papers will be scheduled for presentation during one of the concurrent technical sessions and will be published in the Conference Proceedings.

To submit your paper abstract or workshop or poster proposal Prepare an abstract of your paper or provide a short outline of your proposed workshop or poster presentation.

Submissions are to be made online at: http://welldone.conference-services.net/directory.asp

Sponsorship and Exhibition opportunities are also available
Contact: Judy Potter/Robyn Broughton
HFESA 2006 Conference Secretariat
Email: hfsa@welldone.com.au

5. Reviews of Human Factors and Ergonomics, Volume 1
The new HFES (USA) annual series Review of Human Factors and Ergonomics is available direct from the Human Factors and Ergonomics Society in Santa Monica, USA. HFESA members are entitled to the HFES member discount because HFESA is an IEA-affiliated society. HFES has offered us space in the HFES Bulletin for a complimentary exchange advertisement when desired. Some details about the book can be found at:
http://www.hfes.org/Publications/ProductDetail.aspx?Product ID=75

See a full page advertisement in this edition of Ergonomics Australia


Main theme: Computing systems for human benefits.

The conference will deal with human aspects of hardware and software, with work organization and the labour market. The conference is open both for researchers and practitioners and papers from both categories are most welcome. The conference is endorsed by IEA and further information is available at: www.wwcs2007.se

Welcome to Stockholm in May 2007
Christina Jonsson
President of the ergonomics Society of Sweden (ESS)

7. New design and architecture program on ABC Radio National
Nick Bron, Marketing Manager ABC Radio National has advised Ergonomics Australia about the new ABC Radio National program called “By Design”. Details are available at: http://www.abc.net.au/rn

He may be contacted:
Tel: +612 8333 2694 Fax: +612 8333 2700
Mobile: 0408 261 990 E: bron.nick@abc.net.au

ABC Radio National is the Australian Broadcasting Corporation’s specialist journalism and arts network, broadcasting across Australia. Keep up-to-date with what’s on via its weekly newsletter by subscribing at: http://www.abc.net.au/rn/subscribe/
SOCIETY AWARDS and Call for nominations…

The society presents 7 national awards that reflect outstanding achievement by individuals or groups for service to the Society and the ergonomics profession as well as to the research and application of ergonomics in Australia. Information summarizing the type, eligibility, basis and form of all the Awards is given below:

FELLOWSHIP
"For outstanding contribution to the Society and the ergonomics profession over a period of at least ten years"

- Awarded to a member of the Society in good standing.
- The Award is based on the assessment of the Honors & Awards Committee and ratified by the Society Board.
- The Award is in the form of a membership certificate showing Fellow and confers honorary status.

THE SOCIETY MEDAL
"For outstanding service to and promotion of the Society over at least seven years"

- Awarded to a member of the Society in good standing.
- The Award is based the collaborative assessment of the Society President and the Honors & Awards Committee.
- The Award is in the form of a medal suitably inscribed with the recipient’s name.

CUMMING MEMORIAL MEDAL & LECTURE
"For highly esteemed ergonomics research or application in a relevant area of ergonomics”

- Awarded to an Australian resident, preferably a member of the Society.
- The Award is based on the assessment of the Honors & Awards Committee.
- The Award is in the form of a Medal suitably inscribed with the recipient’s name together with the presentation of the Cumming Memorial lecture at the Society’s Annual Conference.

KEN PROVINS AWARD
"For the best paper presented during the Society’s Annual Conference”.

- Awarded to individual or joint authorship but not for a keynote speaker.
- The Award is based on both the written paper and the oral presentation at the conference.
- The Award is in the form of a Certificate for each author.

ALAN WELFORD AWARD
"For the best paper on an ergonomics topic published in a peer reviewed journal”.

- Awarded to individual or joint authorship, one of whom is a member of the Society.
- The Award is based on the intrinsic merit of the paper itself and its readability for the target audience.
- The Award is in the form of a Certificate for each author.

JOHN LANE AWARD
"For a major systematic contribution to advancing the science of ergonomics and its application in Australia”.

- Awarded to an individual, group or organization having a relevant ergonomics connection with Australia.
- The Award is based on merit and may not be awarded every year. It includes work carried out over several years, during the last five-ten years.
- The Award is in the form of a Certificate.

DAVID FERGUSON AWARD
"For the best postgraduate project report or undergraduate honors thesis”.

- Awarded to an individual student enrolled in a relevant Australian University program of study.
- The Award is based on a paper summarizing the report or thesis together with a supporting statement from the student’s supervisor.
- The Award is in the form of a Certificate plus one year’s appropriate membership of the Society. The paper will be published in Ergonomics Australia.
Note: The Alan Welford, David Ferguson and John Lane Awards relate to research completed and published in the preceding financial year, i.e., the awards in 2006 are for works published in 2005.

To nominate a candidate please complete the form below and send it to:

**Human Factors & Ergonomics Society of Australia**  
Unit 18, Hills Corporate Centre  
11-13 Brookhollow Avenue  
BAULKHAM HILLS NSW 2153

Nominations will also be accepted by email

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Nominations must be received by COB 31 May 2006.
Conference Calendar

2006

11–12 May 2006 — 13th Conference of the New Zealand Ergonomics Society
Marketing for Ergonomists
Christchurch, New Zealand
Email: nzesconference2006@snap.net.nz

11–16 June 2006 — ICOH—International Conference on Occupational Health
Milan, Italy
For more information as it comes to hand consult:
ICOH website: www.icoh.org.sg

29 Jun–1 July 2006 — XVI Congress of ISEK
The International Society of Electrophysiology and Kinesiology
“From Research to Practice”
Torino, Italy
Internet: www.isek2006.it

10 – 14 July 2006 — IEA 16th Triennial Congress — Meeting Diversity in Ergonomics
MECC Congress Centre, Maastricht, The Netherlands
Conference Website: www.iea2006.org
Contact: Ernst AP Koningsveld
Congress Chairman
E: nvve@planet.nl
Internet: www.iea2006.org

28–30 August 2006 — Ergo Future 2006 — Ergonomics challenges for safety and healthy organization of work
Bali, Indonesia
Contact: Adnyana Manuaba
E: adnyanamanuaba@yahoo.com
Internet: ergofuture2006@yahoo.co.id
T/F: +62 361 226 132

20–22 November 2006 — 42nd HFESA Conference
New Technology: Putting Macro and Micro in Context
University of Technology, Sydney (UTS) NSW Australia
Contact: Judy Potter/Robyn Broughton
HFESA 2006 Conference Secretariat
Email: hfesa@welldone.com.au
PO Box 5009 Nowra DC NSW 2541
Tel: +612 4422 2214 Fax: +612 4422 3878
Internet: http://www.ergonomics.org.au

Victoria, Australia 3054
Tel: +613 9335 2577 Fax: +613 9335 3454
E: conference@aioh.org.au

2007

Work with Computer Systems – Computer systems for human benefits
Stockholm, Sweden
Internet: www.wwcs2007.se

Contact: AIOH Administration
PO Box 1205 Tullamarine
Victoria, Australia 3054
Tel: +613 9335 2577 Fax: +613 9335 3454
E: conference@aioh.org.au

Vol 21, Number 1, March/April 2006
Information for Contributors

Articles published in *Ergonomics Australia* are subject to peer review.

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Dr Shirleyann M Gibbs
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25 Melaleuca Drive St Ives NSW 2075 Australia
Tel: +612 9983 9855 Fax: +612 9402 5295
E-mail: shanng@optushome.com.au

**The deadline for issues in 2005:**
- March edition: February 1
- June edition: May 1
- September edition: August 1
- December edition: November 1

**Contributions**
Contributions to *Ergonomics Australia* are always welcomed and encouraged. Articles are subject to peer review and members of a referee panel assist authors in achieving an optimal standard for publication. The activities, achievements, experiences, views and opinions of members are always of interest. These can be in the form of letters, notices, notes, reports, commentaries and articles.

Graphics (photos, illustrations, drawings, computer graphics etc) are particularly welcome and should be camera ready. Photos need not be black and white and negatives are not required. However it should be noted that ordinary digital photographs generally do not allow for good reproduction if only submitted electronically. It is preferable to include the digital photo in the text but to additionally provide an actual photograph which the publisher can scan with commercial quality equipment to produce a quality result.

The preferred form of submissions is via e-mail, either in the body of a message (short notices), or as an attachment (articles / letters). Files may also be mailed on floppy disc or CD. Microsoft Word, Corel WordPerfect or Adobe files are the preferred formats (the editor cannot transcribe Macintosh files that are not in IBM compatible format.) Handwritten or hard copy submissions will only be accepted in exceptional circumstances.

Any inquiries about contributions should be directed in the first instance to the Editor.

Information for Advertisers

**Inquiries**
All inquiries about advertising should be directed to the National Secretariat of the Society.

**Contact**
Ms Pauline Pertel
T: 02 6295 5959 Fax: 02 6295 5946
E-mail: secretariat@ergonomics.org.au
Internet: http://ergonomics.org.au
Tuesday, Wednesday and Thursday 9.00am – 4.30pm

**Size**
The finished page size of the Newsletter is A4 (210mm x 297mm)
Printed column sizes are 165mm x 225mm (double) or 80mm x 225mm (single)

**Advertising Copy**
Must be camera ready and must arrive at the HFESA Federal Office by the Copy Deadline Submission Date for the Edition in question.

A professional advertising service is available for producing camera ready copy if required. For further inquiries regarding this service contact:
Mr Goro Jankulovski, Acute Concepts Pty Ltd
Tel: 03 9381 9696
Mobile: 0414 605 414
E-mail: goro@acuteconcepts.com.au

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These rates are inclusive of GST

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**Enclosures**
Pre-printed enclosures (leaflets, brochures) etc are welcome for inclusion with the Journal.

Enclosures should be pre-folded to fit inside the finished Journal.
Rates for enclosures

Enclosure not requiring folding: $412.50
Enclosure requiring folding: $462.00

These rates may increase if the enclosure weighs more than the equivalent of 2 standard weight A4 pages. These rates are inclusive of GST.

640 copies should be sent to arrive at the ESA Federal Office by the Copy Deadline Submission Date for the Edition in question.

Address for mailing Advertising copy and/or enclosures

National Secretariat
The Ergonomics Society of Australia Inc.
PO Box 7848
Baulkham Hills BC NSW 2153
Tel: +612 9680 9026
Fax: +612 9680 9027
Email: secretariat@ergonomics.org.au
Web: www.ergonomics.org.au

Advertising copy and enclosure submission deadlines for 2005 are the same as for Contributions – 1st of month prior to publication

Edition Submission Deadline
March February 1
June May 1
September August 1
December November 1

Caveats

The views expressed in the Journal are those of the individual authors and contributors and are not necessarily those of the Society.

The HFESA Inc reserves the right to refuse any advertising inconsistent with the Aims and Objectives of the Society and Journal Editorial Policy.

The appearance of an advertisement in the Journal does not imply endorsement by the Society of the product and or service advertised.

The Society takes no responsibility for products or services advertised therein.

Editor
Shirleyann M Gibbs PhD
E-mail: shanng@optushome.com.au

Ergonomics Australia On-Line (EAOL)

Advertising and sponsorship opportunities also exist in the electronic version of this journal (EAOL) which is managed by Dr Robin Burgess-Limerick at Department of Human Movement at Queensland University. It is downloaded by more than 100 Australian and International readers each week. To view EAOL: http://www.uq.edu.au or enter via the HFESA website.