

# ERGONOMICS AUSTRALIA



December 2004



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# Editorial

Another year has passed all too quickly – but not without a wealth of activity affecting individuals at various personal, professional, national and international levels. As with all human activity there have been some good and some regrettable outcomes. The challenge, as always, resides in the responses made and how well or badly people and organizations respond to change, learn from past events and use them to build a sustainable future as individuals and as a society.

Congratulations are in order for the members who received an Award at the Cairns Conference in acknowledgement of their varied contributions to the field and practice of Human Factors and Ergonomics and they are listed on the Noticeboard in this journal. The names of the recipients will be familiar to members since they are well known for their participatory involvement in the field of Human Factors and Ergonomics. The editor was honoured and overwhelmed by the award of the HFESA Society Medal. As she was not able to be present at the Annual Conference in Cairns, the medal was accepted on her behalf by Dr Neil Adams who arranged for Jennifer Long, NSW Chair, to present it to her at the HFESA NSW November Branch Meeting. In accepting the award, the editor thanked her colleagues for this most unexpected honour, having always regarded herself as something of a backroom facilitator. She expressed an opinion that being involved was the only way to gain real benefit from belonging to any group; she thoroughly recommended it as a way to make friends and network with interesting people. Any volunteer position is likely to involve considerable time and effort (and occasional frustration) but the old adage that one gets back far more than one gives is confirmed repeatedly.

At a professional level there has been a steady development of philosophical discussion about the nature of the profession, the diversity of disciplinary backgrounds and future directions that might be pursued following the official name change of the ESA to HFESA. While many of us think it is like water and H<sub>2</sub>O, it must be acknowledged that this is an informed view not a public perception. Ergonomics is a term that emerged in an era when disciplines were neatly packaged as monolithic hierarchies rather than the current trend to multi-, inter- and trans-disciplinary service providers. This is not an isolated problem and could be an excellent topic for discussion in the Forum section in future editions of this journal. There is a continuous dichotomy between tighter specialization parameters and broader general interest communities.

As reported in an article in the Building Services Journal (11/04, p 67) by Julian Amery, The Chartered Institution of Building Services Engineers (CIBSE) Chief Executive, debate is running strongly in the UK construction industry where some people are recommending one institution for the Built Environment that would incorporate architects, engineers, surveyors, project managers and many more. The twelve main professional bodies within The Futures Group of the UK Construction Industry Council commissioned research which noted three key areas for collaboration – co-operation rather than amalgamation:

- *promoting, developing and enhancing workforce skills;*
- *focusing on public affairs and regional developments;[and]*
- *developing knowledge exchange and professional issues.*

The article notes that the Futures Group aspires to being a 'virtual association' that will integrate common activities rather than physical assets. This seems a likely description of what HFESA is offering its diverse disciplinary membership in a slightly different context – as individuals rather than as discrete professional societies. While the very diversity of professional backgrounds represented in the HFESA would preclude organizational amalgamation, the three goals noted above are surely relevant to all members and their related disciplines. The current diversity of membership backgrounds is both a blessing and a problem in terms of community recognition of the scope and depth of HF/E as a unique profession. The greatest future challenge faced on this front is the need to find ways to maximize opportunities for developing community awareness of the real nature and meaning of the term ergonomics. This journal is currently the most obvious means to establish an informed community outreach and it needs your personal involvement.

At a national level the society still seems a long way from a genuinely federal approach. Each of the states has its own program and both the journal editor and the newsletter editor have found it very difficult to obtain state news to share at a national level. While there are many reasons for this situation, most of them are parochial and belong to the pre-internet age when our vast continent posed genuine communication problems. While the society has consolidated its finances and formal governance at a federal level, the local activities of its member branches are largely unappreciated by the wider membership. There are signs of improvement in this area and they must be encouraged to develop for the benefit of members and the wider community as well.

The current President of IEA is clearly concerned about the need to improve international communication among the various member countries. This has begun with several initiatives to increase formal links among the national hierarchies. It is currently limited to multiple one to one links and will take time to establish more diverse and inter-related patterns of communication among the national and international HF/E communities. This is both urgent and possible in ways that did not exist prior to the World Wide Web. A determined effort is being made to improve the information made available on the IEA website and in its electronic newsletter. These tools are of value in direct proportion to their success in becoming a two-way affair between editors and individual and national contributors. These developments are not an excuse to sit back and wait for things to happen. Every individual member has a responsibility for personal participation in the process.

Professional involvement is possible as an individual participant in state and national activities and may advance to involvement in international forums and conferences. By far the most accessible international interaction can occur at the triennial CybErg Conferences which make use of the Internet to avoid the travel, accommodation, absence from place of work, and overall expenses involved in attending overseas land-based conferences. Australians have featured prominently at these events in the past and are encouraged to keep up the momentum.

The next challenge for the editor is to increase public awareness of the benefits of informed HF/E input via a greater journal penetration of the readership market. While the editor can try to influence this awareness she cannot do so without the continued support of her existing journal network which has her eternal appreciation and gratitude ... and a growing input from the wider membership of HFESA. Please inform the Secretariat of people and organizations who should be contacted to become subscribers if not members; or who could see this journal as a most appropriate outlet for advertising their products or services.

The present edition of the journal has a great diversity of input and is an indication of growing confidence in the value of a national publication. It should be a discussion facilitator over the Christmas period when Australians traditionally take time out from regular work activity and stop to make New Year resolutions ... many of which fade with the return to regular routines ... so dear readers, make a resolution to get involved in these pages next year ... and stick to it!

With all best wishes for the coming season and a rewarding 2005

*Shann Gibbs PhD*  
Editor

## May It Please The Court ...

Recently reported in the Massachusetts Bar Association Lawyers Journal, the following are questions actually asked of witnesses by attorneys during trials and in certain cases, the responses given by insightful witnesses:

1. "Now doctor, isn't it true that when a person dies in his sleep, he doesn't know about it until the next morning?"
2. "The youngest son, the twenty-year old, how old is he?"
3. "Were you present when your picture was taken?"
4. "Were you alone or by yourself?"
5. "Was it you or your younger brother who was killed in the war?"
6. "Did he kill you?"
7. "How far apart were the vehicles at the time of the collision?"
8. "You were there until the time you left, is that true?"
9. "How many times have you committed suicide?"
10. Q: "So the date of conception (of the baby) was August 8th?"  
A: "Yes."  
Q: "And what were you doing at the time?"
11. Q: "She had three children, right?"  
A: "Yes"  
Q: "How many were boys?"  
A: "None"  
Q: "Were there any girls?"
12. Q: "You say the stairs went down to the basement?"  
A: "Yes"  
Q: "And these stairs, did they go up also?"
13. Q: "Mr. Slattery, you went on a rather elaborate honeymoon, didn't you?"  
A: "I went to Europe, Sir."  
Q: "And you took your new wife?"
14. Q: "How was your first marriage terminated?"  
A: "By death."  
Q: "And by who's death was it terminated?"
15. Q: "Can you describe the individual?"  
A: "He was about medium height and had a beard."  
Q: "Was this a male, or a female?"
16. Q: "Is your appearance here this morning pursuant to a deposition notice which was sent to your attorney?"  
A: "No, this is how I dress when I go to work."
17. Q: "Doctor, how many autopsies have you performed on dead people."
18. Q: "All your responses must be oral, OK? What school did you go to?"  
A: "Oral."

19. Q: "Do you recall the time that you examined the body?"  
 A: "The autopsy started around 8:30 pm"  
 Q: "And Mr. Dennington was dead at the time?"  
 A: "No, he was sitting on the table wondering why I was doing an autopsy."
20. Q: "You were not shot in the fracas?"  
 A: "No, I was shot midway between the fracas and the navel."
21. Q: "Are you qualified to give a urine sample?"  
 A: "I have been since early childhood."
22. Q: "Doctor, before you performed the autopsy, did you check for a pulse?"  
 A: "No."  
 Q: "Did you check for blood pressure?"  
 A: "No."  
 Q: "Did you check for breathing?"  
 A: "No."  
 Q: "So, then it's possible that the patient was alive when you began the autopsy?"  
 A: "No."  
 Q: "How can you be so sure, Doctor?"  
 A: "Because his brain was sitting on my desk in a jar."  
 Q: "But could the patient have still been alive nevertheless?"  
 A: "It is possible that he could have been alive and practicing law somewhere."

*[Ed: the above item is another of those snippets circulated among friends via the internet]*

## President's Column

My first pleasurable duty on stepping into the President's shoes is to thank, on behalf of the incoming Executive, our immediate predecessors, Margaret Head (President), Les Hogg (General Secretary) and Jenny Kerr (Treasurer), for leaving the HFESA in such excellent shape and to wish them well. They have very ably steered our Society along a path of continued development and positive change over the last two years and have thus made this transition, for us, an exciting one. Shortly, I will say a little more about what Louise Whitby (Treasurer), Rebecca Mitchell (General Secretary) and I, together with your Board of Directors, are planning.

Firstly, however, congratulations are also in order for each of the hardworking volunteers of the Queensland Branch of the HFESA. The Executive hand-over occurred, of course, at the recent 2004 Annual HFESA Conference in Cairns QLD – a wonderful and valuable affair at which I think we had one of the, if not the, largest proportion of overseas attendees ever. A pleasing majority of these came from our Pacific Rim neighbours and very great thanks are due to our longstanding colleague and friend, Barbara McPhee, for laying the critical early groundwork for this success. Barbara has been ill for some time, but in her inexorable recovery is displaying the tenacity we know and love. Best wishes, Barbara and Jim. I trust we can continue to cultivate more and stronger regional and global connections in the coming years, particularly as we are now eligible, with a membership exceeding 500, to have a second Australian representative join our David Caple on the International Ergonomics Association. The next Conference will be in our nation's capital (no, not Sydney...Canberra), so mark your diary and make your plans now!

The opening months of this new position have been, for me, a curious mixture of both frenetic activity to get up to date with everything and subdued reflection about where we've come from and where we are to head. Just after the recent Federal election, one of the letters published in the Sydney Morning Herald stated "The election result means that the majority of Australians have chosen to live in an economy rather than a society". On reading this stark comparison, I was unable to avoid reflecting on where we, as a profession – or perhaps more accurately, as a body of related professions – reside. Do we operate within a purely economic framework where actions are justifiable only in cost or productivity terms; or is our world defined by humanitarian pursuits – health, comfort, satisfaction, safety – for the betterment of our human lot?

My view is that we of the HFESA are fortunate to be involved in a Society that represents professions for whom both the above are not only possible, but are often achieved in harmony. I know I'm preaching to the converted when I say that well designed systems – systems that optimally accommodate both human and technical factors – are productive, safe and satisfying for all concerned. You know this. But I remind you of it in order to ask: How many people have you given that message to today, or in the last week, or month? How more well-known is the science and practice of human factors and ergonomics because of your involvement? And is our Society more populated because you've explained this to a colleague who might be as interested as you in our fascinating field?

We live now in times when the need is greater than ever for sound human factors and ergonomics input both to large social issues such as work-life balance and the design of working hours, and to discrete, yet still vitally important, individual problems like the design of portable computing devices. The range and diversity of potential applications is so great that we will benefit enormously by bringing together, and networking and collaborating with, professionals who, although from widely divergent backgrounds, work on the problem common to us all – the design of the interface between “us” and “it”.

Our Society’s Aim is to advance the science and practice of human factors and ergonomics in Australia by promoting research, education and application of its principles. Underpinning any such grand effort is resources – and in a not-for-profit volunteer organisation, resources are inevitably rarefied. However, a little effort by a large number can often achieve very much. For example, if we – each member of our Society – made it our personal goal to talk to one new person each week about our work, our discipline or our Society then, each year, over 25,000 more people would know about Human Factors and Ergonomics!

We all benefit greatly from our involvement in this field, and among the tasks ahead for your Board and Executive is to increase those benefits to you. However, with the benefits of belonging to a professional society come responsibilities. Playing your part in raising awareness is vital if we are to expand the professional base of HF/E practitioners, researchers and educators, or markedly increase demand for our services. But, with increasing interest in our Society and its activities, we must also have something substantial to offer. To this end, pre-eminent among our new duties will be a review of both our Membership and the Society’s infrastructure, especially in the area of information provision, communications and IT. We will be having our first Board teleconference this month. High on our agenda will be discussion regarding a survey of members and related professionals, the development of a specific strategy to enhance our ICT capabilities to permit our website to play a more active, and interactive, role, and dealing with the issue of membership structure to accommodate recent changes and future challenges.

In relation to recent changes, our Society’s name change has meant that we now should alter our post-nominals from “MESA” to “MHFESA” (and similarly, “FESA” becomes “FHFESA”), although formal carriage of this decision must await next year’s AGM. As to future challenges, the membership structure discussions I mentioned above will be focussed on the issue of professional certification to accommodate our broadened horizons. In the meantime, “CPE” remains the post-nominal for our members with professional certification and I urge those who are eligible but have not yet applied for certification to do so. If you have any queries about these or other matters, don’t hesitate to contact our National Secretariat, Jennifer Allen. She will either help you directly or ensure you are contacted by someone who can. A very large part of the increased, and continually increasing, efficiency of our National body is due to the wonderful combination of diligence, reliability and enthusiasm that Jennifer brings to her work with us and we all owe her a very great debt of thanks.

Finally, I am honoured to have the opportunity to be able to speak to you via the medium of Ergonomics Australia. This, our flagship, has become a high quality, peer-reviewed and eminently presentable journal under the visionary stewardship of Editor Shirleyann (Shann) Gibbs. Supporting the radically changed profile of our Journal, we have also begun the production, now in its third issue, of a national (and yet to be named) newsletter in which it is intended to consolidate all the useful and newsworthy material with a more local and informal flavour than the more formal Journal. Our Newsletter Editor, Christine Zupanc, has, like Shann, moved mountains and parted seas in order to present a high quality product. They have both done a marvellous job, but as we all well know, endurance is inversely related to effort and they cannot persist without your support. Talk or write to them both. Tell them, and thus tell us all, what is happening in your corner.

We will soon be more directly asking for your help and guidance to take our Society continually nearer to its goals. In the meantime, remember, ... just one person a week. ....

*Max Hely  
President, HFESA  
November 2004*

# IEA Column

This IEA report includes an extract about the IEA 2004 Council Meeting held in Madeira, Portugal in July this year as originally reported in greater detail in the September edition of *Ergonomics Australia*. It also covers my trip to Brazil as the keynote speaker to the ABERGO Conference.

Although the 2004 IEA Council meeting was not held in conjunction with the major triennial congress, to be held in 2006, it was extremely well attended by delegates.

On the evening prior to the Council meeting, I convened a meeting with members of the International Development Standing Committee. We had virtually all members present to overview the activities of the past year.

The discussion during the Council meeting highlighted:-

- A formal adoption of the EQUID project. This will now formally explore opportunities for the IEA to find ways of identifying and promoting the use of ergonomics processes in the development of product or service design.
- Development of a new communication strategy through the redevelopment of the IEA Newsletter and the IEA website. This will expand the content and coverage to improve the status of the IEA site as a primary hit for the general community seeking information on ergonomics.
- The expansion of the International Development Program to work collaboratively with other professional associations and peak international agencies including ILO and WHO.
- The refocusing of the Development Committee to provide more assistance to the current and prospective Federated Societies and their members as well as the linkages of the ergonomics profession within a broader environment, particularly focusing on business, government and industry links.
- A consolidation of the 21 technical committees through the removal of committees that are no longer active, as well as the introduction of a number of new committees in emerging areas of ergonomics.
- The formation of advisory committees to revise the educational and training standards adopted by the IEA.

A further feature of the 2004 Council meeting was the conduct of a number of participative workshops to enable the delegates to informally discuss a range of issues. In reflection on Pierre Falzon's visit to Australia, and other countries, he specifically was interested in developing strategies for closer linkages between the IEA and the Federated Societies. One outcome of this was a process of direct communication between the IEA President, and the Presidents of the Federated Societies.

The 2005 Council meeting will be in San Diego, USA in July. It is my intention as the HFESA delegate to represent our members at this meeting. I would welcome any comments or requests that I may present at this meeting.

During the HFESA conference in Cairns this year, I was travelling to Fortealeza Brazil, to provide the opening keynote address to the ABERGO conference and also to conduct a workshop on office ergonomics. This was a memorable experience from a number of perspectives.

It was:-

- The first time I had spoken to 600 people all wearing headphones for simultaneous translation into Portuguese.
- A challenging but fun opportunity using simultaneous translation whilst conducting a participative workshop.
- A feeling of disempowerment to be prevented from boarding an international flight to Brazil from Santiago, Chile as I did not have the correct visa in my passport. This was 3pm on a Friday with my presentations on the Sunday, and the embassy about to close until the Monday! Thanks to the kind assistance offered by an airport employee, I was escorted through customs, immigration, currency, and driven to the Brazillian embassy where, with 5 minutes to spare, I eventually was provided with a visa. As I had missed my flight I was then challenged to continue my onward journey. I eventually arrived at Fortealeza at 2am on Sunday with my workshop happily commencing at 8am with the audience none the wiser about my ordeals. Such are the joys of international travel where a planned 3 day trip in Brazil can be easily foiled.

Since Pierre's visit to Australia in March, he has subsequently also visited Federated Societies in Canada, and the ULAERGO conference in Santiago, Chile.

*Best wishes,  
David C Caple  
HFESA Delegate*



# Reports

## ERGONOMICS FOR A BIZ-E WORLD – HFE 2004 CONFERENCE

**Ken Horrigan**  
**Chairman HFESA Conference 2004**

Well, everyone who came seemed to have a good time (which is very pleasing to the organising committee). HFE2004 was a wonderful small scale international conference with ergonomists from all over the world. HFE2004 was set in Cairns at the best possible time for the weather, eating, drinking, shopping and tours. The Conference Dinner was held at the award winning indigenous Australian cultural centre Tjapukia. It was a good night with Alan Hedge and our other international visitors able to participate on stage and take part in traditional smoking ceremony (and get to try out a didgeridoo).

Oh, and there were also great workshops and papers. We really succeeded in presenting the wide scope of ergonomics and human factors, from safety and design to error and efficiency.

Keynote Speaker, Professor Alan Hedge, got the ball rolling with a spirited call for us to be promoting ergonomics as a business benefit as well as a people benefit, even if we need to re-brand ourselves. Graham Storrs did little to allay anyone's fear of flying. Jonathon Talbot presented a fascinating look at design for people by people. Everyone was impressed by his student designs; we all wanted a Uan rug and an Anemone lamp (although we were not so sure about the interactive park bench that forced you to get involved with strangers). Ron Cumming would have been proud of Robin Burgess-Limerick's memorial lecture. He would have been pleased to see to where the Society has advanced. Lynn McAtamney rounded off the invited speakers presentations on the final day with a vision of how we will be moving forward.

The ManTRA workshop was so popular Robin Burgess-Limerick and Roxanne Egeskov had to keep running it. Alan Hedge's, Graham Storr's and Justin' O'Sullivan's, Verna Blewett's and Ken Horrigan's workshops were also over subscribed, but there is always room for one more (or a few more). Alan Hedges Pre-conference Workshop and Maurice Oxenburgh and Pepe Marlow's Pre-conference Cost Benefit Workshop were well attended and reportedly very well received. The site visit to the call centre was an eye opener for people who had not had the opportunity to inspect a good call centre. The Health and Aged Care Forum rounded off proceedings very nicely and our thanks go to Nita Maynard, David Trembearth, Mark Dohrmann and Mark Hennessy for putting it together.

It was all very satisfying for an organising committee that managed to lose its Chairperson and Treasurer on the way (We have since found them). Thanks to the Local Core Committee of Trudy Tilbury, Belinda Cox, Justin O'Sullivan, Ken Lorme, Michelle Koripas and Ken Horrigan (Special mention to Trudy who was the local in Cairns and bore the brunt of the last few hectic weeks). Thanks also to the other locals who were part of the Committee and helped out greatly in the early stages and at various times throughout the process – Jim Carmichael, Melanie McGaw, Donna Lee and others. Thanks also to the Interstates and Federal Executive – Margaret Head, Jenny Kerr, Verna Blewett, and Barbara McPhee.

Thanks to Rachael Glover and Jennifer Allen from the HFESA office (and their partners who made good volunteers). Thanks to the Board for their support and advice. Thanks to all the Biz-e ergonomists who put in their papers, who peer-reviewed the papers (thanks CPEs), who prepared their wonderful presentations, who entertained and informed us with their presentations, who asked the very interesting questions during question time, who prepared and presented their workshops, who entered the photo competition and who prepared posters. Thanks.

And a final thank you to our sponsors who help to make it all happen – the Queensland Government Department of Industrial Relations who sponsored our invited speakers (Thanks Judy, Thanks Jim), Ergonomics Office, Linak (who set a world record for giving away mouses) and Powdersafe.

*Ken Horrigan*  
*KHorrigan@hradvantage.com.au*



Queensland Group at HFE2004



NSW Group at HFE2004



## MILLER'S TALES

### Trouble with expert witnesses

*[This article first appeared in "Engineers Australia" (October 2004 page 40) and is re-printed with permission. Thanks to Owen Evans for suggesting this.]*

#### Peter Miller

The evolution of the expert witness concept slipped unexpectedly into turbulence last month, at least in NSW. Things seemed to be going along steadily after most jurisdictions had adopted formal rules for experts which established a primary duty to the court and a requirement for impartiality and completeness. I had been looking forward to some evidence that experts are standing firm on that secure foundation and refusing to be tempted into partisanship; but suddenly some evidence seems to point in the opposite direction, towards unbridled partisanship and greed.

It began with a brief flurry of investigative reports in the *Sydney Morning Herald*, focusing on the dark side – or would some say the bright side? Here is a small sample of the material:

"A town planner or a traffic engineer, for instance, can earn tens of thousands of dollars for their evidence – far more than they would from town planning or solving traffic problems. ... Some planners have been known to arrive at a site and say: 'Alright, I have seen the site, now what do you want me to say?' ... Sometimes an expert is hired to give credence to the obvious – such as an occupational therapist asked to testify on the cost of a wheelchair in a personal injury case. ... Sometimes they are called to drown dry facts in complexity – such as accountants and actuaries who use wildly different statistical models to assess economic loss... 'The market for expert witnesses has become increasingly competitive, with several new players entering the market over the past two years' (one web site manager referring to other websites) ... Australian experts have not yet reached the unbridled partisanship of their colleagues in the United States, where witnesses spruik for jobs by advertising their win/loss ratios. But charging on a no win/no fee basis, which was outlawed in the US, has become common practice."

The NSW Legal Services Commissioner said he had received complaints about lawyers entering deals with witnesses for a share of their fees. The NSW Land and Environment Court has moved towards court-appointed experts, believing their evidence to be less biased. It is reported that judges are reluctant to accuse witnesses of bias because they might have to disqualify themselves in a future case in which an accused witness appears, disrupting the court process and adding to already high costs. The NSW attorney-general has referred some issues to the NSW Law Reform Commission. As yet I have been unable to see the details of the reference but it is said to include consideration of sanctions. The NSW Supreme Court is reviewing its approach. There is some evidence of differences of opinion within the High Court.

What seems clear to me is that the trouble is not with the system but with the behaviour of people within the system. It would be a great pity if the system moves to prescriptive regulation with sanctions. That would run counter to the emergence of an environment in which professionals who assist the judicial process by providing it with access to knowledge see themselves as performing a public duty in which integrity is sacrosanct.

*Peter Miller AM DEng  
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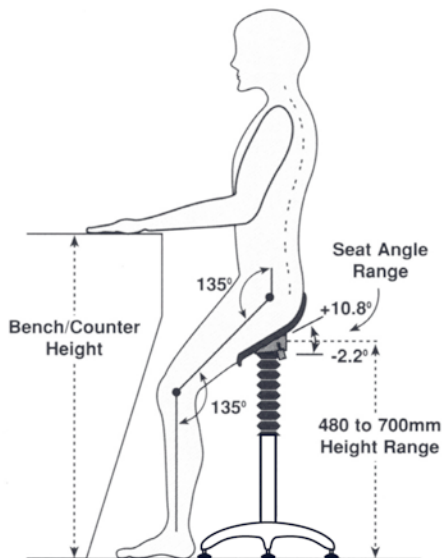
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SSS-EVA

# Articles

## RON CUMMING MEMORIAL LECTURE 2004

### A TALE OF TWO ACRONYMS: PERFORM AND MANTRA

Robin Burgess-Limerick

#### Introduction

It gives me great pleasure to present the 2004 Ron Cumming Memorial Lecture. In the lecture I will present my views on the best way forward towards preventing injuries resulting from manual tasks. Rather than duplicating the content of the lecture, my intention in this accompanying paper is to provide a context for my remarks and further detail of some of the research underlying them.

I began conducting research related to manual tasks in 1990 in a laboratory based research program. (see Abernethy et al. 1996; Burgess-Limerick, 1994; 2003; Burgess-Limerick & Abernethy, 1997a; 1997b; 1998; Burgess-Limerick et al., 1993; 1995; 2001) It is worth noting that this program of research was initially funded by an extra-mural grant from the National Occupational Health and Safety Commission, in the days before the government put a stop to that sort of nonsense.

While this research has informed my views, the research upon which the Cumming lecture will be more directly based commenced in 1999, when WorkCover Queensland (through QComp) indicated it was prepared to consider funding research directed towards reducing the cost of claims. It was perhaps an accident, but research on injury prevention was included as a possible topic in the documentation which accompanied this announcement (a call for research proposals in a subsequent year did not). I rang Roxanne Egeskov, then Leon Straker and Clare Pollock, and a new research program was born. This program initially focussed on conducting a randomised and controlled trial of a participative ergonomics program for manual tasks (which came to be called PERforM) in a group of 48 small to medium sized workplaces in diverse high risk industries. (Straker et al, 1994)

This research demonstrated a reduction in injury risk, as assessed by WHSQ inspectors, for those workplaces randomly assigned to receive the intervention. It provides the best evidence available to date for the effectiveness of a participative ergonomics program in reducing the risk of injury associated with manual tasks.

As well as funding from QComp and the National Health and Medical Research Council, this project also required the cooperation and in-kind support of Workplace Health and Safety Queensland, in particular through the audits conducted by WHSQ inspectors as the primary outcome measure. (This level of cooperation between government and university researchers is unprecedented to my knowledge and has been cause for comment wherever I have presented the results.)

One of the by-products of the project was the development of a manual tasks audit tool to be used by the inspectors (which came to be known as ManTRA). The original version of ManTRA was devised by the investigators before being trialled by inspectors and revised. This version of the tool was used by WHSQ inspectors during two state-wide blitz audit programs conducted in conjunction with the project. In South-East Queensland alone 1211 tasks examined as part of 264 workplace audits were coded using the tool. On the basis of this experience, the tool has been further revised for future use. ([ergonomics.uq.edu.au/download/mantra2.pdf](http://ergonomics.uq.edu.au/download/mantra2.pdf)). A workshop on the use of ManTRA will be held later in the conference, and further details of the logic of the tool are provided below.

In addition to the initial evaluation of PERforM, current projects funded by ACARP and Coal Services Health and Safety Trust and conducted in conjunction with the Minerals Industry Safety and Health Centre (UQ) have involved tailoring the program for coal mining and the program has been implemented to varying degrees with miners at 12 surface and underground coal mines in Queensland and New South Wales. One of the outcomes of these projects is a handbook and video for training staff in managing manual task risks in surface coal mines. (Burgess-Limerick, 2004; Burgess-Limerick, et al, 2004) Future plans include adapting the program for the construction industry.

#### ManTRA

ManTRA arose out of a need to provide WHSQ inspectors with a general purpose field tool for the assessment of manual tasks risk. The tool needed to be sufficiently general to be used with the complete range of manual tasks, including tasks involving repeated exposure to relatively low force levels, as well as the risks associated with less frequent exposure to high forces. Existing quantitative risk assessment tools are only strictly applicable in very limited circumstances, and are consequently unsuitable for use in many, if not most, real world tasks.

Multiple biomechanical risk factors (exertion, awkward postures, vibration, repetition, and duration) are simultaneously implicated in injury causation. While exposure to a single risk factor alone may cause injury, injuries are far more likely when exposure to multiple risk factors occurs. A risk assessment tool was needed which allowed simultaneous assessment of multiple biomechanical risk factors.

Injuries associated with manual tasks occur to specific anatomical structures, rather than to the body as a whole. An appropriate risk assessment tool requires independent assessment of the risk of injury to different body regions rather than a global assessment of whole body risk.

The complex nature of the cumulative causal mechanisms involved and the individual differences in tissue tolerances is such that dichotomous threshold values are inappropriate. Seldom, if ever, can it be said that on one side of a threshold lies safety, while on the other lies injury. Risk is always a function of exposure, and while the function may not be linear, it will never be a step function at a population level. A risk assessment tool should acknowledge this, providing an indication of the degree of risk, rather than simply presence or absence of risk. On the other hand some quantitative tools provide results from which greater precision may be inferred than is warranted.



A common response to the need for such a field tool has been to provide checklists consisting of “yes/no” questions, most of which involve qualitative assessment of the presence or absence of a risk factor. Such checklists are of limited utility, in particular because they provide little assistance in determining the relative threats posed by different risk factors, or the priority attached to different tasks in any way beyond the “number of yes” responses. Such checklists may be useful as part of a risk identification process, however an appropriate tool for manual task risk assessment should provide an indication of the relative contribution of different risk factors to the overall risk to facilitate effective targeting of controls.

A tool designed for general field use should not be overly complex, nor require the use of measurement equipment. The tool should be useable without requiring lengthy training.

To summarise, the criteria proposed for a general purpose manual task risk assessment tool are that the tool:

- a) is applicable to the complete range of manual tasks;
- b) provides an integrated assessment of biomechanical risk factors;
- c) provides an independent assessment of injury risk to different body regions;
- d) provides an overall risk assessment which allows prioritisation of tasks but does not imply a misleading level of precision;
- e) facilitates effective targeting of controls by providing an indication of the relative severity of different risk factors within a task; and
- f) does not require expensive equipment or lengthy training.

Further details of related issues and an assessment of existing tools against these criteria are provided in an issues paper commissioned by NOHSC as part of the current review of the National Standard and Code of Practice (Burgess-Limerick, 2003). Existing tools were deemed not to meet these criteria, and ManTRA was developed to try to meet these criteria.

The original version of ManTRA combined information about the total time for which a person performs the task in a typical day (exposure) and the typical time for which the task is performed without break (duration) with a semi-quantitative assessment, for each of five body regions, of five characteristics of the task (cycle time, force, speed, awkwardness and vibration). Scores for cycle time, and duration of continuous performance scores, are combined to derive a rating of repetition risk (on a five point scale). Force and speed scores are similarly combined in a rating of exertion risk, while awkwardness and vibration scores are used as a rating of the risk associated with these task characteristics. The aim was to provide a tool which was both consistent with the Manual Tasks Advisory Standard against which the inspectors were judging workplace compliance, and consistent with current understanding of manual task risk factors.

The ratings for each risk variable are then combined and assessed independently for each body region. A maximum rating for exertion for any body region, or a high rating (4 or 5) for both exertion and awkwardness, indicates a high risk of acute injury,

while a high risk of cumulative injury is indicated by the presence of multiple risk factors for a particular body region and assessed by calculating the sum of the five risk factors (Total time, Repetition, Exertion, Awkwardness & Vibration).

A paper describing the reliability of the tool is currently under consideration (Burgess-Limerick et al., submitted), and limited validity information is available in the form of correlations between ManTRA scores and subjective discomfort measures for a sample of manufacturing tasks which will be presented by Valerie O'Keefe at this conference. On the basis of the analysis of data from 1211 tasks coded by the WHSQ inspectors, the tool has been revised, with the main change being to reduce the number of body regions to be coded to four, combining neck and shoulder as one region; and arm, elbow, wrist and hand as another. An open question remains regarding the degree of training and knowledge required to achieve satisfactory results.

### PERforM

Participative ergonomics approaches which take as an underlying assumption the notion that the people involved are the experts and must be involved at each stage of the risk management cycle if the process is to be executed successfully (Haines & Wilson, 1998). In an occupational injury management context, this implies in particular that employees and management participate through risk identification, risk assessment, risk control and review steps of the risk management cycle. Workers are assumed to be the experts, and the role of the ergonomist in this context is to facilitate the process and provide the expertise necessary to undertake the process. Ideally, skills transfer also occurs and the risk management process created is sustainable without further intervention.

Successful implementation of a participative ergonomics process requires management commitment. In some cases this is the hardest step to achieve, but it is an essential step. Without management commitment the process will inevitably fail. There are many HFESA members concerned with how best to achieve this step through both the demonstration of persuasive cost-benefit analysis and the appropriate role of government agencies in promoting the development of this commitment.

Another essential element in a participative ergonomics process is effective OHS management systems which will facilitate the risk assessment process and the evaluation, prioritisation, and implementation of risk control suggestions which result. Again, there are many HFESA members concerned with ensuring optimal management systems are implemented by diverse organizations.

Another essential ingredient, and the one with which I have been most concerned, is the requirement for the staff involved in the risk assessment and risk control activities to have the knowledge and tools required to participate. One focus of the Cumming lecture will be on illustrating parts of the training devised as part of PERforM. While PERforM involved a number of aspects including processes aimed at ensuring management commitment and effective management systems, the core of the program is training employees in manual tasks risk management

The design of PERforM was influenced by Leon's experiences in implementing a similar program in the UK National Health Service. In devising the employee training component of PERforM we were acutely aware of the reality of limited time available for staff training in many workplaces. Where participative ergonomics programs have been evaluated in the past, the typical conclusions run something like – that was great, but two days training is too long. Our challenge was to reduce the training duration to 3 hours, ideally delivered to intact work teams in two 90 minutes sessions.

This constraint meant that some of the key decisions were about what to leave out. The aspect which caused the greatest discussion during our deliberations was related to the exclusion from the program of any details of anatomy. While everyone would certainly benefit from knowing something about their bodies (we should all read the manual), we were about stripping the training back to essentials, and in the end, we decided that it is not essential to know anything about anatomy to effectively assess and control manual tasks risks. This can be confronting for some health professionals who may feel that this is diminishing the importance of their knowledge base.

The first 90 minute training session of PERforM concentrates on providing an appreciation of direct risk factors for manual tasks injury – Forceful Exertion, Awkward Postures, Vibration, and Repetition and Duration; and the use of a simplified version of ManTRA for documenting the degree of exposure to each of the risk factors.

One of the key characteristics of the training is the use of workplace specific video footage gathered on an earlier visit to explain the different risk factors. The focus here is on explaining concepts such as the role of acceleration in contributing to exertion risk; what makes awkward postures “awkward”, including highlighting static postures; the consequences of whole body and peripheral vibration; and repetition as a separate risk factor. The session typically concludes with practice in the use of the risk assessment tool as a group exercise using workplace specific examples.

The second training session focuses on risk control. The risk control hierarchy is explained and emphasis is placed on the preferability of elimination, substitution and design controls over administrative controls. A framework for thinking through design and administrative options is presented, along with an explanation of the pitfalls associated with some options. Emphasis is placed here on seeing safety and productivity as compatible goals rather than competing priorities. If a control is to be successful, it must be the fastest and easiest way of doing the task.

A further exclusion from PERforM is any attention to training in manual handling techniques, beyond pointing out that such efforts are a particularly ineffective administrative control. Whilst sound principles of load handling such as *keep the load close and avoid trunk rotation* exist, there is only minimal potential for training in such principles to contribute to reduction in injury risk. Training efforts should instead be directed at training staff in manual task risk assessment and control, and ensuring that

the control suggestions which result from such a process are developed, refined, and implemented (and then assessed again!).

This can also be a confronting conclusion for some; however the evidence is quite clear that manual handling education is not, on its own, an effective risk control strategy. Research across a range of industries has led to the conclusion that manual handling training is not effective in eliciting persistent change in behaviour of uninjured workers. (eg., Chaffin et al., 1986; Scholey, 1983; Snook et al., 1978; St. Vincent et al., 1989; Videman et al., 1989)

There is often a problem, due to low power, in interpreting the absence of evidence for an effect, as evidence of no effect. In this case, however, the conclusion is relatively unambiguous. Daltroy et al (1997) completed a randomised controlled trial involving 4000 postal workers and found no long term benefits of training alone. This conclusion is echoed in a recent review by Silverstein & Clark (2004, p. 136) who wrote:

*There was very little evidence presented that back schools have any lasting effect. There may be some temporary effect in the first six months but it is not sustained over time.*

One response to this observation is to ask “how can the training be improved so that it is effective?” This path leads to a dead end – even if sustainable behavioural change could be effected, the reduction in injury risk likely would be minimal. A response which is more likely to be productive is to accept that attempting to alter behaviour is not an effective means of reducing manual tasks injury risk. Instead, the only effective way of reducing manual task injury risk is to eliminate or reduce risk through implementation of design controls, and in turn, that the most effective way of developing and implementing such controls is via a participative ergonomics process. This is the best path forward for manual tasks injury prevention.

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# A MANUFACTURING CASE STUDY

## EXPLORING THE CHALLENGES IN DEVELOPING EFFECTIVE ERGONOMICS SOLUTIONS

Belinda Cox

### 1. ABSTRACT

*This case study explores the complex macroergonomics interactions, both internally and externally, that have been necessary for a micro ergonomics intervention to proceed within a manufacturing company. It also identifies crucial factors for successful integration of discrete interventions within a commercial environment. Three frameworks are used to illustrate the concept of macroergonomics in a contemporary manufacturing setting. The importance of remaining part of the integration process for a successful ergonomics outcome is highlighted. Whilst excellent solutions may be proposed, for any number of reasons their execution may not be possible for the work organization. Ergonomists need to be familiar with the tasks of the work teams and to be part of the learning curve that results from sharing knowledge and experiences with the client. Only when this combined effort is implemented are innovation and effective ergonomics solutions possible.*

### 2. INTRODUCTION

*Conceptually it is entirely possible to do an outstanding job of micro ergonomically designing a system's components, modules and subsystems, yet fail to reach relevant system effectiveness goals or criteria because of inattention to the macroergonomics design of the system. (Hendrick, 1991)*

In recent years, there has been a gradual acknowledgement of the importance of considering both macroergonomics and micro ergonomics. The term macroergonomics relates to optimising the organizational system and considers the interactions between the social, organizational, technical and environmental sub-systems. (Kleiner and Drury, 1999) Outcomes tend to be measured by larger scale indices such as organizational cultural change and organizational performance improvement. As outlined by Kleiner and Drury (1999), interventions are not entirely within an ergonomist's control and ergonomists cannot operate in isolation. The term micro ergonomics relates to detailed ergonomics interventions undertaken within a subsystem. This awareness of macroergonomics has generated a greater interest in understanding the work organization and highlighted the need to integrate management practices and organizational design into ergonomics interventions. The US National Institute of Occupational Safety and Health (NIOSH) said in 2000 that:

*... the work organization is influenced by factors such as economic conditions, technological change, demographic trends and changing corporate and employment practices. There are major changes and trends occurring in business, technology and society that can represent new forms of work organization and therefore have potentially large impacts on the work system... (Carayon and Smith, 2000)*

The challenge for ergonomists seems to be in mastering the integration of their interventions with their client companies. (Zink, 2000; Brown, 2000) Organizations are dynamic and changing structures that respond to market forces and community influences. For ergonomists to integrate discrete micro ergonomics interventions successfully within a work organization, a greater understanding of its work systems and external environment is required. Each company presents with a unique set of features including product, technology, management practices, goals, market conditions, corporate culture and methods of work. The influence of the external environment as it impacts on business strategy is broad and complex, considering demographics, culture, politics, legal frameworks, technology and education. (Nonaka & Takeuchi, 1995; Hutton & Giddens, 2001; Hendrick, 1991)

Increasingly, authors are documenting the importance of macroergonomics approaches for the success of micro ergonomics intervention. (Hendrick, 1991; Robertson, 1991) Despite the range of macroergonomics methodologies cited in the literature, such as participatory ergonomics, systems analysis modelling, organizational human engineering, and work systems design, it remains difficult to find really practical tools that incorporate macroergonomics features. (Hendrick, 1991) Given the complexity and variety of organizations and the broader global environment, a range of these tools is likely to be required. Robertson (1991) has called for the documentation of an international database of macroergonomics tools. Whilst this is supported, ergonomists will also need a collective understanding of the parameters for each tool, preferably demonstrated with real life case studies.

Ergonomists need to be sensitive to the unique characteristics and experiences of each individual and organization in terms of attitudes, preferred work methods and workplace culture and hierarchies. They need to select interventions that are in line with these characteristics. Perhaps therapeutic concepts for individuals could be extrapolated to jobs and organizations to create lasting and sustainable ergonomics interventions.

Ergonomists are dealing with dynamic organizational entities and must view and respond to an organization holistically. They must acknowledge that for its own evolution and survival, a multi-dimensional and constantly changing system is continuously reacting to industrial environments and market forces. While the various theoretical bases (physical, psychological, social and organizational) are relevant to ergonomics interventions, they need to be adapted for sustainability within a client's existing system, products and services. Ergonomists may increase their effectiveness by using contemporary concepts of organizational knowledge creation associated with innovation. (Nonaka and Tekuchi, 1995) The macroergonomics goal is to create a better outcome through the sum of the parts.

Inevitably, there are constraints for the ergonomics solution that can be undertaken within a corporation. The presumed perfect solution must be tailored for each organization. Carayon and Smith (2000) recognise that frequently it is not possible to eliminate all the factors that create workplace stress and other health and safety problems. They cite various examples of this situation including inherent job characteristics, finance and technology constraints, and customer demands and expectations.



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Therefore the work components which can be targeted for possible hazard reduction must be balanced against areas that cannot be improved. Robertson (1991) believes that ergonomics solutions should be developed through participative problem solving based on local practices and understandable problems. Whilst this brings a certain level of grounded, outcome focused solutions, it may also limit creative or lateral thinking. Hammond (1996) considers solutions are derived from continual improvement, refinement, working with what is available, and striking a balance between each unique element in the organization. Both tend to adopt an approach that allows the evolution of change processes within the organization's own time frame. Whilst this may be a general approach, there are instances where a major paradigm shift is needed to provide a satisfactory solution.

### 3. BACKGROUND

This case study examines an international food manufacturing company that produces a variety of bakery and food products. The factory employs fifty five production staff (forty five permanent, ten long term casuals), twenty five salaried staff; and operates three shifts per day, five day weeks (fourteen production shifts plus a sanitation shift) with seventy percent of the work completed on one production line. The company appears to be genuinely concerned about the health and safety of its workers and highly motivated to be among the best in its industry.

The company engaged an Occupational Health and Safety (OH&S) Consultant in 2001, a year that its Workers Compensation premiums were at their highest. The rise in premiums had occurred as a result of a new calculation structure that considered the cost of workers compensation claims over the previous three years as well as common law claims over the previous five years. In November of the same year, an ergonomist was engaged to review the ergonomics issues associated with folding croissants on their major production line. The report essentially was to be a review that would assess musculo-skeletal risks associated with folding and pinching croissants.

In December 2001, a report was tabled outlining recommendations for addressing machine feeding (production) and design issues, work practices, environmental issues, ancillary equipment requirements and staff education. While short term interventions were provided within the recommendations, the fact that they would not significantly reduce the hazards for personnel and financial risk was highlighted since as a large proportion of the problems arose from inherent design constraints. Following the compilation of the ergonomics report, the company established a project team comprising the plant manager, production manager, OH&S consultant, ergonomics consultant, a production line worker and the company engineer. Advice was also taken from the marketing and quality assurance (QA) departments during the development of solutions. The company was seeking solutions to identified problems and was willing to investigate various macroergonomics considerations and processes.

### 4. REVIEW PROCESS

With hindsight, additional concepts that would have been useful during the review process have been incorporated in this present discussion. Three separate ideas have been applied to the process of decision and intervention – gap analysis, work psychology and balanced work systems.

In the first place, the enabling factors involved in the company's decision making processes are examined. The concept of **Gap Analysis** that was developed by Jim Joy (2002) from a model created by Everett Rogers, maps five stages in the innovations decision process. Whilst this method provides a linear map of a sequence affecting decisions, it does not capture the vast number of broader work systems that need to be considered when introducing a solution for a micro ergonomics problem. Secondly, a useful framework for a future project team is found in the area of work psychology. Strohm and Ulrich's framework for organizational analysis provides a useful macroergonomics checklist or structured approach for reviewing the impact of a micro ergonomics change in a manufacturing environment when introducing new technology. The framework is used to demonstrate the issues that arose in considering the impact of ergonomics change on different sections of the business. Finally, the concepts of a balanced work system and a healthy organization are applied to the practicalities of providing a macroergonomics intervention. Carayon and Smith's concepts (2000) capture the reality of implementing an ergonomics change. Whilst an ideal solution may be sought, invariably compromises will be required.

### 5. THREE FRAMEWORKS

#### 5.1 Gap analysis

Gap analysis maps a linear five stage innovations decision process, which commences with knowledge and progresses through stages of persuasion, decision, implementation and confirmation. Information used in the gap analysis was gathered through a survey and interviews with staff.

- Stage 1 – Knowledge – is affected by prior conditions and knowledge as well as the attitudes and characteristics of the decision makers.

Prior conditions set the basis for decisions to be made. Within the company, prior to the engagement of the OH&S consultant in March 2001, there had been little documentation of a worker's compensation and safety data. There were subsequent common law claims, which had not been documented or incorporated as business risks. While injured staff participated in rehabilitation programs they were also working in a restricted capacity on the line. The associated costs of this dual activity had not been calculated as part of production costs and therefore were not visible in the company's performance data.

Data collection was initiated in March 2001 and records over the subsequent six months demonstrated to management that additional costs were being incurred. For example, one hundred and twenty days had been lost through two staff undergoing surgery for carpal tunnel syndrome. In addition, the company



was covering costs for an onsite physiotherapist and an onsite massage therapist following recurrent complaints (neck, shoulder, upper limb and less commonly for low back pain). The OH&S consultant also commenced a system of hazard reporting, which revealed various issues associated with the main production line such as a need for:

- provision of foot support on the line;
- removal of obstructions under the line (to avoid bumping knees, heads);
- relocation of the line control box (dangerous at head level);
- removal of sharp edges on the line.

According to the Production Manager, OH&S consultant and National OH&S Manager, prior to the ergonomist's report in December 2001 there had been a general awareness of problems on the main line, but these had not been articulated or quantified. Previously a range of assessment tools had been utilised, including pain charts, a structured questionnaire, video analysis, anthropometric comparisons and Rapid Upper Limb Assessment (RULA) data. The last two items appeared to offer the best means of understanding the impact of the job components and the work environment. The ergonomist provided recommendations for remedying the short term hazards through use of administrative or low level controls. Issues that could not be improved without redesign or further organizational intervention were acknowledged.

Four out of the five staff that formed part of the project group rated the ergonomics report as extremely important (on a five point Likert scale) in justifying the cost expenditure required to upgrade the croissant production line. The other person rated it as somewhat important. The National OH&S Manager noted that obtaining objective analysis of the tasks, detailing the ergonomics issues and obtaining feedback from staff had enabled the OH&S department to scope the issue and put forward a Capital Expenditure Proposal (CEP). The Production Manager indicated that the ergonomist's report had afforded the conditions to generate change since it highlighted the peak of injuries in 2001; the subsequent need to reduce the incidence of serious repetitive injury; and the hidden financial costs that previously had not been incorporated in company statistics.

A key starting point for implementing change is recognition of the fact that without knowledge, awareness and understanding, change is not likely to occur. In this case study, the basis for initiating change first occurred through the introduction and analysis of injury records, followed by management staff observing line staff as they worked in awkward postures. Once this information was reported to the National OH&S Manager, Engineer, and Plant Manager, further awareness was generated about the uncomfortable working conditions – as well as their affect on OH&S issues resulting from the sheer volume of product being generated on that line. The engagement of an ergonomics consultant provided objective data about the production line operation. That information could help management to quantify the company's risk exposure and justify seeking approval for capital expenditure to implement change.

Before the project could be approved, five levels of management needed to be persuaded of its importance. During the persuasion process, considerable effort was required from both non-management and managerial staff to gather information, organize and understand data and to prepare a proposal for capital expenditure that would be presented to the various directors. A Capital Expenditure Proposal (CEP) was subsequently submitted seeking money to remedy the line. Significantly this also raised awareness among senior levels of management by providing knowledge about the hidden risks or costs to the company in terms of Work Related Musculoskeletal Disorders (WMDS's). The directors thereby became more aware of the potential financial risks in other plants owned by the company (as later reported by the Production Manager).

Traditional macroergonomics approaches (Hendrick, 1995) are seen as having a top down approach instigated by management. This project would initially seem to have had a bottom up approach, driven by staff to management.

*Characteristics of the Decision Makers.* Whilst a formal analysis of individuals had not been undertaken, a consistent theme and commitment to employee welfare is documented in the company's policies, employment practices (work life balance, support of production line project, health week activities) and staff reports from all levels. The company reports indicate a commitment to health, safety and wellbeing, with the aim of achieving an employer of choice status, as defined by the Annual Hewitt Survey. (Hewitt Asia nd)

During the project, the Production Manager reported improved staff morale since staff seemed to have confidence in management support. Communication channels appeared to be open and to have a low power distance. The OH&S and Production staff seemed to have direct communication links to the responsible Director and Plant Manager. Line staff also appeared to have direct communication with the Plant Manager who visited the line each day. Management style was perceived by the Production Manager to have changed from a reactive to a proactive approach to the identification of possible OH&S issues. He also reported that following the introduction of team meetings, line staff had offered many good safety suggestions for improvements and there was a commitment to ensuring all feedback (positive or negative) was sent to higher levels of the organization and that follow-through occurred. He further indicated that there was a strong focus on the efforts of line staff and on future directions for the team. It would seem that true participative principles were being enacted.

- Stage II – Persuasion – involves perceived characteristics of any innovation.

During the process of knowledge formation, some key developments occurred in this company to form the basis for persuasion and for future assessment of new processes. There was a paradigm shift in thinking and a change in the methods of assessing, evaluating and communicating information to management about the impact of any proposed interventions. Data gathered by the Production Manager and the OH&S Consultant expanded to include a review of payroll figures, cartons per hour figures, and staff run on the line per hour; and these provided negative variance figures to production costs. Existing workers' compensation figures were examined;

projections of possible future claims (workers compensation and common law) were made and then incorporated in production costs. Lastly, the line staff on restricted duties were also factored into production costs. Once all costs were detailed, the Production Manager stated that a broader concept of the true production costs was being appreciated and reported as part of company statistics. A major shift in understanding had occurred for everyone involved, with statistics providing a more accurate picture of the company's financial status.

The Production Manager and OH&S consultant subsequently established some base units per minute for the croissant line: these were derived from machine operating capacity; averages of staff fold speeds; and required carton attainments. This provided an average work rate for croissants folded per minute. That figure was subsequently used to share workloads more evenly on the line (a previous source of staff conflict). It was also stated that this approach provided some standard production measures across the factory for such things as cartons per shift and kilos per shift in order to assess the impact of proposed production or technology changes during work trials – prior to their implementation (see section three) and to communicate these details to management.

A project team was set up to scope an improvement project. It comprised the Plant Manager, Production Manager, National OH&S Manager, OH&S Coordinator (on site), plus Engineering Manager and engineering contractors, a line representative and the Ergonomics Consultant. The team explored options and innovations for eliminating croissant folding; redesign of the line and subsequently sought capital approval. The Production Manager was nominated as project champion to manage and drive the project. Various methods for seeking capital funding were explored by on site members of the project team. When it was evident that savings could not be paid back within two years under the categories of profit adding (labour saving or profit sustaining) required under the CEP system, the project was submitted under the title of *Management of OH&S Risk* in late October 2002 and subsequently was approved.

The Production Manager believed the project had required strong leadership to succeed and survive the persuasion stage. A staff survey perceived the greatest challenge to the project had been the instability caused by the turnover of key personnel. Throughout the process, a new Plant Manager started in January 2002, the OH&S Consultant was replaced by a salaried OH&S Coordinator, the National Engineering Manager left and the project's engineering contractor was changed. Despite these disruptions the project continued and was eventually granted an \$87000.00 improvement budget.

The Production Manager reported that having a senior production line staff member championing the project on the line had been pivotal to the acceptance of the project by staff affected by the change. His perception was that management was demonstrating to line staff that it was aware of the repetitive nature of their work and was attempting to improve the overall ergonomics design of the line. By establishing a consistent work pace for all line staff, he anticipated a reduction in staff friction since some were working considerably faster than their colleagues. Further improvements in workers' compensation premiums were also anticipated.

One hundred percent of staff surveyed, anticipated the first benefit of the innovations to be reduced human strain. Eighty percent anticipated improved staff satisfaction/morale and quantity output on six of the possible cost benefits. In considering the physical work environment, sixty percent expected improvement to be extremely significant. On worker health and safety and job satisfaction, eighty percent expected improvement to be somewhat significant; compared with sixty percent who anticipated productivity improvement would be somewhat significant. Quality, profitability and efficiency (material input and waste) influences had varying but mostly minor expectations from staff surveyed.

- Stage III – Decision – involves adoption or rejection

As noted previously, five levels of the organization were needed for project approval. This involved each level of the company examining any factors deemed to be relevant to them before signing off on the project. The project was subsequently delayed at Director Level while other options were explored.

As part of the project team's exploration of solutions, a hierarchy of risk control was addressed systematically. The principal of elimination was explored via two methods prior to approval of the redesign project. The first involved the Sales and Marketing Department testing customer response to alternative product presentations (which resulted from the removal of unnecessary repetitive hand actions for their creation); and determining whether the new style would retain market acceptability. This apparently generated some interest and even supported the idea for other possible markets using fewer staff on the line. Details have been withheld for reasons of commercial confidence. The second method involved the engineering department in exploring technological advances in machines that could automatically bend croissants, thereby eliminating the need for manual folding and pinching. Whilst other companies apparently had been seeking this solution as well, it is still likely to be several years from realization. Other solutions needed to be explored once the engineer confirmed there was no commercially viable automated equipment that could run at the current speed of production.

Prior to approval of the project the future of pinched croissants had to be considered at a higher management level (CEO, Director and Plant Manager). Alternative market options also needed to be explored along with possible future company directions in relation to the possibility of eliminating or reducing the repetitive hand actions associated with pinching and folding of croissants. In weighing up the cost benefits of investing in the project, the company needed to consider both its strategic direction and any possible product changes that might occur. The Plant Manager highlighted his need to ensure that any upgrade to the production line would handle increased capacity from new business that was being developed, such as larger mixes and greater production.

The project was eventually approved, some sixteen months after the initial ergonomics report was tabled; and four and a half months after the CEP was submitted. The project was accepted as being an OH&S project in line with company objectives – the values of looking after people and their welfare. Although it was not primarily seen as a cost saving project (which would aim at decreased staffing and waste), the company was aware that there could be hidden savings (reduction in injuries) and indirect savings (reduced lost time injuries). When approval was given for

capital expenditure, there was no defined pay back outlined (such as increased production). This would indicate a genuine commitment to company values in terms of caring for staff in a practical manner.

Musculo-skeletal disorders are seen to have an insidious onset, often developing some time before people are aware of them. In accepting this project, the company seemed to have maintained a long term vision of their staff and their business, which is beneficial for the strategic management of such work related disorders. The company also appeared to have considered multiple level interventions: the organization, the job and the individual.

At the time of project approval, the company was reported to be set within a buoyant market where significant growth was anticipated, new products and technologies were being explored and increased contracts were anticipated. A range of factors had needed to be considered including the external market, company performance, future directions of the company, as well as the cost of human and business risk. Whilst macroergonomics concepts have traditionally been considered to involve a top-down approach, both bottom-up and top-down approaches had been necessary for this project to proceed.

- Stage IV – Implementation

During the implementation phase, there were major challenges and some breakthroughs. The site is set on 1960 square metres (1200 square metres of factory space), providing significant space and layout constraints to any introduction of new processes or machinery. Space is extremely tight, however sections of the production line were not being used at all. As part of the goals of improvement, the decision was made to transfer product to unused sections of the line, thereby providing more working space for line staff. Within the extreme space constraints, the solution was to direct product above the line. Once a greater delivery height was introduced, there were implications for product quality in ensuring that product was delivered without deformation to the line. In addition, the production line was to be raised to ensure a better fit for the majority of the population rather than only the 5th female percentile. Prior to the project, staff had been sitting on drafting chairs with very poor postures owing to the thickness of the line, which restricted possible hip angles and trunk and upper limb postures. Originally, the goal was to reduce the thickness of the line. Further exploration by the engineer determined that this was not possible without compromising the integrity of the metal, machinery warranties and the ability to use a cutter on the line. Project goals needed to be reformulated based on this fixed feature. It provided a real life example of the need to work with what you have in place.

*Engineering:* challenges involved finding solutions for raising the line and ensuring that it connected to other sections of the line and to attaching components. The challenge of directing product further up the line to create more line space also had to ensure that product delivered to the line arrived in the preferred orientation and with little deformation. In addition, solutions to clearing leg obstructions and supports from under the line were required. Attempts were made to take electrical ducting overhead but this proved to be impossible because of quality issues.

Alternative options for placing the ducting within the present line and folding the belt inside this, were also explored and found to be not possible. The final challenge was in creating a flexible foot support for staff that needed it. The foot support was not addressed prior to the completion of the line redesign, despite the importance of this being highlighted by the ergonomist. It was subsequently addressed after the existing line was raised.

In relation to seating, since the thickness of the conveyor could not be reduced, alternative seating was explored. Seating needed to allow staff to use the greater hip angles created by the thickness of the line, and also to allow height adjustment for appropriate trunk and upper limb postures. This involved trialling chairs and seeking staff feedback on the different seats throughout the project. Initial feedback from line staff supported the continued use of the current drafting chairs. These were not an option since staff could not sit at an appropriate height for upper limb tasks and still position their legs under the line. Staff had been perching on the front of their chairs with their backs hyper-extended; their backs and legs unsupported; or their chairs adjusted lower to clear the conveyor line and cause shoulder elevation. The company goal was to provide both sitting and standing for staff working on the line within the job rotation system. Two chairs were trialled – the sit stand chair and the saddle seat. Within a multicultural workforce, there were cultural considerations in the use of the saddle seat for some of the women working on the line. When polled, line staff voted to retain both seats with a standing rotation.

*Production:* addressed job rotation to the best of its ability, along with the use of stretching breaks and the reduction of waste. It also undertook simple changes throughout the process such as moving the head height controls; and purchasing wider belts; whilst maintaining production and managing staff welfare. Production maintained communication with line staff on project developments and promoted future changes. It monitored the implications of proposed line changes on other products that needed to be manufactured on the same line; as well as considering maintenance and cleaning issues. Team diligence also avoided the introduction of new problems for production output and staffing. When a line belt required replacing, the Production Manager took the opportunity to purchase a new wider belt, which was one of the original ergonomics recommendations. Production also examined staff reports about the effects of different pastry temperatures on the ease of pinching dough, as well as air flow issues around the freezer end of the line.

*OH&S department:* regularly supported the process and continued championing the project. It continued to push the project during staff changes and maintained a strong presence and interface between production and management. Recording and presentation of data was maintained for all staff. Health weeks and lifestyle balance initiatives were developed during the same period.

The project was incorporated in the company's business plan and was reported to be the largest investment in OH&S improvements in the company for no required return. There seemed to be a genuine commitment to, and focus on, the project and on ensuring its completion. This attitude survived staff changes and a company take-over.



- Stage V – Confirmation

Confirmation is described by Joy (2002) as the decision, support and confirmation from each person that they will continue to use the innovation. In this instance there was continued support from all organizational levels for proceeding with this project in spite of the long lead time between approval and implementation as well as the considerable time spent exploring options. Incredibly, regardless of staff and project team changes, the project progressed through a variety of organizational changes, interventions and a culture of innovation. The reality of the difficult role faced by an external consultant was evident during a follow up visit to the site. It was disappointing to see that the feed conveyor depositing product to the unused section of the line had been placed at eye level over the line. This is work area for three line staff (used by all line staff in the process of job rotation), and resulted in an obstruction in front of their faces that blocked communication with colleagues on the opposite side of the line (a desired feature reported by staff because of job repetitiveness). The (external) ergonomist had not been consulted about this design feature and it had resulted in the inadvertent creation of another problem.

## 5.2 Analysis of an Enterprise

*... organizations are processes where interrelated actions are continually and cyclically affecting each other. Hence, the focus of the analysis should be on the future where the business plans, priorities and inter-relatedness of technological developments, strategic directions as well as company values and philosophy and corporate culture are considered. (Robertson (1991))*

The Gap Analysis framework seemed to provide a linear map of processes and conditions that supported innovation. By contrast, Strohm and Ulich's (1998) multilevel analysis of an enterprise addressed multiple layers of people, technology and organization. It seemed to offer a structured method for examining the organization as a whole – the relationships between components of the organization, and work groups and individuals. In hindsight, if applied to this case study it could have been used to provide a structured format for examining the work systems that need to be considered when introducing a technological innovation in a manufacturing setting. Using this format, the case study is re-examined in the following eight sections.

- Management – Goals of the Enterprise, Product and Market, Competition Strategy, Organization of the Enterprise, Innovativeness, Economic Situation.

Corporations are affected by a range of contemporary influences such as technological change; open global financial markets; the knowledge economy; ethical business; human rights; work-life balance and ecology; and the rising level of organizational sophistication. Management needs to consider its business strategy and requirements; human capital; liabilities and responsibilities; and market position; whilst remaining competitive through innovation and delivering a profitable business. The company used in this case study is influenced by its country of ownership (USA) and of production (Australia), in terms of legislative frameworks and litigation. Within the global business community,

there is greater corporate and individual accountability for a variety of contemporary issues, not least of which is OH&S, which impact management's understanding of its responsibilities.

In the company under discussion this awareness has been used positively as part of company policy for risk management and the health of its staff and business. The company goal is to be within the top ten employers of choice, as assessed by the annual Hewitt survey of Australia's Best Employers. The organizational goals are seen to include the regular components of productivity, profitability, market, and resources; but additionally to embrace social responsibility and innovation. (Hendrick, 1991)

The economic situation of the company was seen to be buoyant both locally and overseas, with annual site production increasing by 33 % in sixteen months. New products were being tested and new markets created. Any new technology introduced had the potential to impact on any changes made to the working environment resulting from micro ergonomics recommendations. As previously detailed with Gap Analysis, management needed to monitor and consider the company's overall competition strategy in relation to any proposed ergonomics changes. Despite significant staff changes throughout the project, the goals of this company appear to have provided a focus to ensure the project continued.

- Sales – Market and competitive environment, Customer orientation, Marketing, Distribution, Offer process

*...Manufacturing companies are facing increasing competition and uncertainty. Change, improvement and innovation are intrinsic parts of the rhetoric and reality of our times...many organizations have invested and are continuing to invest, in a wide range of practices that are designed to help business become more competitive by improving quality, increasing responsiveness to customer needs and reducing costs. (Clegg et al, 2002)*

Responses to a shifting market, customer needs and cost reduction are essential for companies to remain competitive. (Clegg et al, 2002) The close working relationship of sales and marketing departments with customers and product development forms a necessary partnership that also features in macroergonomics interventions. As previously outlined, to obtain the necessary capital expenditure for this project, the marketing department needed to explore alternative production methods that would remove unnecessary hand actions associated with bending croissants. The National OH&S Manager noted that capital investment is more likely to be granted when a product has a strong market presence that is in great demand by customers.

- Engineering – Type of developmental and design tasks, Make or buy decisions, Norms and standardization, Project Management, Documentation Process

As discussed under Gap Analysis, the engineering section was involved in exploring alternative plant technologies that could bend croissants and work within existing production requirements, thereby addressing the issue of elimination as a hazard control strategy. The documentation of objective data used to support or defer the purchase of available equipment, or to undertake

modifications requiring capital expenditure, was essential for decision making about the full elimination of croissant folding. The scoping and documentation for the capital expenditure proposal was undertaken by the engineering department.

The need to conform to existing industry and food quality standards needed to be considered when addressing the implications of modifying existing plant – including manufacturers' warranties; metal integrity; logistics of connecting raised sections of the line with others sections of the plant; and maintenance issues associated with new plant. It was important to ensure that product was not damaged and that contamination was not introduced as part of any change. Minimum engineering standards were required to shield staff from motion sickness that might be caused by viewing moving parts.

- Production – Production requirements, Type of production processes, Logistic concepts, Production systems, Production techniques

The Production Manager was a key person in providing the practical interface between production requirements and personnel management; his support and active involvement in the project was essential. This was demonstrated by his diligence in monitoring the possible OH&S impact when purchasing new equipment or changing processes; considering maintenance and cleaning issues; and by purchasing wider belts (as recommended) when replacements were necessary. This was undertaken in conjunction with the usual activities for ensuring the required production output was met; the normal scheduling of different products occurred; staffing to allow the necessary breaks and schedules was adjusted; and staff morale was maintained. The logistics of moving other items of equipment on or off the existing conveyor and their subsequent impact on other production areas and systems needed to be explored, as well as possible future work methods flowing from the proposed micro ergonomics change.

As mentioned earlier, the various work speeds indicated a discrepancy of 250% among personnel and this had created tension on the line. Benchmarks were set for the croissant rolling speeds that staff should maintain. The solution included slowing down work speeds of long term workers; coaching by more experienced staff; and creating a culture of equity; as well as opening communication opportunities in team meetings for the discussion of any tensions and their likely solution.

The line was stopped for people to take breaks (one twenty minute and one thirty minute tea break taken by everyone together and two six minute stretching breaks). According to the Production Manager this yielded positive feedback from staff; greater teamwork; better compliance with stretching programs; and unanticipated positive outcomes for production – carton rates increased by 17 % which then created better labour cost figures. The outcome was that the line progressed from giving the most inefficient performance to being one of the most efficient lines in the space of one year. The frequency of quality mistakes was reduced from weekly to monthly figures.

The Production Manager was given control of the maintenance budget, which ensured that money was available each month for improvements as well as for large projects. There appeared to be a commitment to continuous improvement in the work environment and this incorporated solutions suggested by staff members.

- Personnel – Personnel and qualification structure, Personnel selection, Personnel development, Reward System, Model of working hours, Turnover and Rates of absenteeism

The production line developments were set against a background of evolving personnel structures over a two year period. The first OH&S consultant to be engaged was instrumental in setting up systems, structures, and records; staff education and training; identifying issues of concern; and for engaging the ergonomics consultant. After eleven months, a permanent OH&S / Human Resource (HR) coordinator was appointed.

Throughout this period the personnel selection process was altered. The labour hire company was changed and a selection brief and screening process was established by the new company to ensure selection of the right people. This development included process readiness training with an experienced staff member (coach) in a controlled environment before placing staff on the line.

Staff development was implemented in a variety of ways from training to mentoring. Line staff were coached by a Level Three staff member. The Production Manager reported that whereas previously the line had been stopped to review procedures in relation to quality, training and team development had resulted in greater self monitoring by line staff. Both informal and formal processes for mentoring were instigated with salaried staff across the organization. The Plant Manager introduced informal mentoring with staff on site. Formal training in areas of food processing, front line management, and leadership development were introduced for salaried and line management staff (and later line staff) in accordance with the National Qualifications Framework.

In line with the company's philosophy of work-life balance, all salaried staff ceased work at lunch time each Friday. This included staff not accessing their emails from Friday afternoon across the weekend. The model of working hours was required to be followed by all levels of the organization, including management.

Rewards and recognition programs were put in place nationally with teams given monthly points on a league ladder for addressing issues relating to OH&S, QA, productivity (line efficiencies), and compliance (through audits). Bonus points could be achieved through positive performance indicators such as tool box talks by supervisors and hazard identification. Monetary incentives were introduced to reward staff along with other rewards that were allocated to people who did something well by way of operation, innovation, thinking outside the box, or being part of a winning team.

A number of other changes occurred as the result of the establishment of national contracts; and with having various suppliers engaged for other areas of the business such as labour, freezer, uniform, waste, and people development.

- Technology – Computer strategy, Hardware configuration, Use of computer-aided systems, Technical information networks, Organization of information

Technology in this manufacturing setting would cover research and development concepts as well as manufacturing plant materials and technologies, although computer technologies could also be relevant at some stage. Throughout the project the technological changes continued as a result of research and development of new processes and production methods. It was necessary to consider changing markets and future manufacturing processes when implementing any changes.

The technological advances in croissant folding were explored when the means for the elimination of hazards were being considered. Although available, automation did not provide a commercially viable option. The issue of working with currently available technology also extended into areas such as the inability to reduce line thickness using existing materials for constructing plant; the current size of electrical ducting; and methods of providing an electrical source for the line. The available industrial seating options formed part of the technological component when considering macroergonomics interfaces.

- Quality – Quality philosophy and policy, ISO 9000/TQM, Quality Assurance and optimization, Guarantees and warranty, Quality assurance manuals and guidelines

Quality issues needed to be considered among the development of solutions. Overhead ceiling options were explored when attempting to relocate electrical ducting, but this could not be utilised as overhanging structures could not be permitted above the product zones. Product integrity needed to be maintained during the development of engineering solutions in order to avoid deforming the product when dropping it onto the line.

The research and development team was consulted in relation to the temperature requirements for the product on arrival at the line. Staff had reported that the dough was colder and more difficult to pinch at the commencement of the line. After examination of temperature requirements no changes could be made to the temperature of the dough on the line.

- Environmental Policy and Ecology – Environmental management, Recycling, Waste disposal, Regulations and legal constraints, ISO 14001, Ecological end result

Although strict environmental management was not a significant part of this project, the reduction of waste was being addressed via improved quality output from operators folding product on the line along with improved engineering and production practices.

The contemporary concepts of Quality, OH&S and Environmental policy / ecology are seen as critical to any company, particularly those in manufacturing. In reviewing the company in terms of this framework, it would appear that OH&S has been neglected. Perhaps Strohm and Ulich (1998) saw it as having less priority or as part of all the outlined work components. The later would appear unlikely, since it is not documented in their sub-categories. The company under review in this case study was noted to have an OH&S Policy and to have completed a Safety Map across all sites, in order to standardize its OH&S systems and procedures.

The multi-level categories nominated by Strohm and Ulich in 1998 seem to provide an organizational framework of subsystems (apart from the absence of OH&S) that needed to be considered during the project. They do offer a macroergonomics view of the potential impact of a micro ergonomics intervention on other subsystems within an organization.

Whilst the Gap Analysis captured the decision process and Strohm and Ulich's method of analysis captured the interrelated subsystems within the organization, neither captured the constant trade off that occurred. The reality of achieving the perfect ergonomics outcome in this case study appeared to have been addressed conceptually by an organizational development framework called the *Balanced Organization*. The process of implementing micro ergonomics intervention, resulted in the trade offs that necessarily occurred in order to achieve the best fit for this organization. Participation from all areas and levels of the company were necessary to establish solution parameters within the current external and company environment.

### 5.3 The Balanced Organization

*... A 'balanced' organization [is] ... an organization that takes into account business goals and human outcomes, that examines the positive and negative aspects of work/organizational system design, and that minimizes the negative (human and organizational) outcomes. (Carayon and Smith, 2000)*

As outlined above, the company was committed to achieving both corporate and employee health. This link according to Carayon and Smith (2000) is a crucial feature of a Balanced Organization having the potential to integrate the micro-level factors (individual and task) with the macro-level issues at organizational level. A balanced work organization is defined as a constellation of inter-related work systems (people, strategy, structure, rewards, and processes) that form an organizational group. Within each of these systems are five elements (the individual, tasks, tools and technologies, physical and social environments, and organizational conditions). The organization is recognised as being a dynamic system and participates in continuous improvement and constant change. Such features are necessary parts of operating within turbulent times. The benefit of this framework is that it does not highlight any one particular feature, but examines the organization as a whole. It also makes a realistic inspection of the work organization, acknowledging both positive and negative aspects.

Whilst monitoring the macroergonomics features and processes arising from this micro ergonomics project, the broader system elements were also observed. Each of these work system elements was considered to be relevant to achieving overall system success. Whilst some elements are captured in the previous framework, this approach acknowledges the reality of balancing and trading off features to optimise human and organizational outcomes. The definition of success then becomes one where a best fit is achieved for that particular organization.

### 5.3.1 Work organization

The components of people, strategy, structure, rewards and processes have been partially captured in previous frameworks and will not be repeated in this section. Those that may not have been outlined specifically before, but could be included in an organizational analysis, are policies of recruitment and selection; and the cultural diversity present within the factory. Both have the potential to affect the work organization. Organizational strategy and goals are varied and have been documented above. Values have been captured in relation to the company and individual commitment to people and the provision of a safe and healthy work environment. As previously outlined in this case study, various reward methods were implemented and incorporated within HR policies to promote healthy work practices, OH&S performance and innovation. The company has a national recognition program that acknowledges both individuals and work groups doing something well. Those factors which have been covered extend beyond operational objectives to capturing and encouraging more creative thinking approaches. Processes in this company have remained dynamic and are continually changing. Over a two year period of observation, there has been continuous improvement at various levels within systems, the organization and staff development. Mapping process changes given the level and frequency of evolution that was occurring in the company was difficult for an external consultant. This presents significant challenges for any ergonomist attempting to integrate ergonomics interventions with a dynamic and changing entity. As an external consultant the person is brought in intermittently as required by the business – but decisions made one day may not apply in changed circumstances. This was illustrated by the placement of a feed conveyor at eye level being installed without any involvement of the consultant ergonomist.

### 5.3.2 Work systems

**Individual factors** influencing work systems are recognized as being physical (energy expenditure); physical status (biomechanical strain); psychological (personality, past experiences and social situation); and behavioural (motivation/coping) resources that are constantly changing. On an individual level, the one to one massage sessions (only fifteen minutes per week) provided by the company were a small step in addressing individual physical factors (staff were encouraged to seek further treatment if individual problems were identified). Individual mentoring on the line might assist in reducing psychological and biomechanical strain and energy expenditure associated with bending croissants. Enforced stretching breaks may provide feedback on physical status for early identification of a poor musculo-skeletal condition. Broader system components which may have an individual impact are noted in Section 6.3 of this paper. Regular team communication meetings provided a barometer of individual and team needs. All staff members were encouraged to provide feedback and to participate in improvement of their work practices. Within a balanced organization employees are encouraged to continuously improve their job and the overall organization. (Frohman, 1997 in Carayon and Smith, 2000). In this case study employees were given authority to stop the line in order to stretch. Although this was authorized it was not being fully utilised; which reflects individual psychological factors relating to empowerment.

The word task is used to describe both physical and mental job demands; machine pacing; and job control. In this case study a highly repetitive job was observed to be machine paced and offering little variety or job control. Job design evolved to provide some level of control for employees by having the line stopped for stretching breaks; by having all line staff taking tea breaks together; and by incorporating staff suggestions through the medium of team meetings. Even when a rotation system was introduced, the options for rotation remained limited and were utilised within the constraints of what was possible. As outlined above, whilst line staff members were given the option of having the line stopped for stretching breaks, this has not been fully utilised. Whilst some organizational culture adjustments are still required, there has been some improvement in task design by allowing limited job control in a machine paced environment.

**Tools and technologies** refer to adequate skills to undertake a given task; the threat of job losses through technology; and the influence of poor workstation design. Staff pinch standards and mentoring were introduced, as well as process readiness training prior to staff placement on the line. The workstation design features that were able to be changed have been addressed to improve layout. Engineering also addressed issues arising from poor product placement on the line and this reduced unnecessary hand actions for line staff. Exploration of appropriate seating options was undertaken and resulted in staff selecting two styles of chair that could be utilised within the constraints of conveyor depths. Staff created a rotation schedule on the line comprising both sitting and standing postures, as part of a company requirement to ensure positional change.

**Physical and social environment** includes the various components of noise, lighting, temperature, air quality and workplace layout. The ergonomics review identified environmental issues of air temperature and air flow around the freezer entry, as well as equipment items affecting layout. As part of the redesign, workplace layout was addressed within the constraints of a very small factory floor space in order to create more workspace for staff on the line. According to the Production Manager there had been some friction on the line with staff working at differing fold rates. This impacted on the social environment and was being addressed by setting a required pinch standard, with random assessment, checks and coaching from the level three line staff member. The decision to have all staff attend breaks at the same time was reported to have improved team morale and the overall social team environment.

**Organizational conditions** include the way in which new technology is introduced; work scheduling; career development; organizational support such as training; and time for new staff to acclimatize as well as for existing staff to cope with changes. Over the two year period of the project staff were advised about progress by a team champion (on the line) and in the Production Manager's team meetings. Prior to the final installation a presentation was given by the Ergonomist and supported by the OH&S Coordinator and Production Manager, about the range of design issues that were able and unable to be addressed – including reasons for needing to consider new seating. Staff trialled alternative seating options throughout the project period and were asked to provide feedback on the seating. A vote by



staff was taken before final selection of seating for use at the line. Since staff were actively included and involved as part of this change process there was considerable lead time for acclimatization.

The introduction of a level three position created a limited career structure. Formal training and mentoring was introduced for new line staff prior to commencement of work; and also for existing line staff in relation to the actions for rolling and pinching croissants. Salaried staff members are now required to undertake a range of National Certificate Courses for staff development and food processing. This development was supported further by a formal and informal mentoring program.

As permanent and salaried staff members are rostered to work on a regular day, afternoon or evening shift, the issue of adjusting to rotating shift work and its impact on family and social arrangements have been minimised in line with the company's focus on health and work-life balance. Salaried staff members cease work at lunch time each Friday in accordance with this philosophy.

### 5.3.3 Work systems organization

Different sectors are networked in a unique way within an organization. The changing nature of an organization changes as it is influenced by economics, demographics, changing corporate practices, technology, and work force diversity. These factors are influenced by concepts of teamwork, participation, empowerment, greater links between employees and customers, quality improvement trends, restructuring and re-engineering.

In order for this project to progress it required each sector of the organization to be involved as outlined earlier in this paper. External feedback from customers was also sought. The necessarily complex web of interactions and processes has been documented using the frameworks discussed above. Unrelated to this project the company underwent a merger with another organization; changed its name twice; and had various critical staff changes. While all these things were happening the company remained competitive in a global manufacturing environment and responded to market influences.

To ensure the success of micro ergonomics projects for individuals and organizations, the concepts of a balanced organization must be integrated with other concerns. Balance challenges relate to organizational health versus individual health; balancing all stakeholders needs (individual, customer, business); ensuring the participation of all stakeholders; promoting individual and organizational learning; and the balance of responsibility and power. (Cooper and Cartwright, and Frohman cited in Carayon and Smith, 2000). Each time a decision was made in this project to balance or trade off a component, the impact of that decision needed to be examined and understood by all work systems in order to develop a satisfactory new solution. In hindsight, the use of Strohm and Ulich's (1998) multilevel analysis may have provided a systematic approach for doing this more effectively. When the decision to reduce the thickness of the line to improve posture was not able to be achieved by engineering, further options needed to be explored such as alternative seating. In optimising the height of the line to obtain a best fit for the

majority of the workforce, other solutions needed to be considered for the population extremes. When staff reported that they would prefer to sit at the line, but guidelines for musculo-skeletal health favoured positional change, a compromise was reached between staff preference and management responsibilities for employee health. When a commercially viable solution for bending croissants was not able to be considered, other risk management strategies were adopted. When electrical ducting could not be taken above the line because of QA issues, other options were necessary to suit employee needs. Space constraints for layout and electrical requirements for size of cabling had to be considered.

While discussing the internal links and networks within a company, the direct links that the organization has with its customers are also part of the unique way a particular organization operates. Commercial in confidence requirements prevent the detailed nature of this aspect being described, but such links are part of an organization's identity.

## 6. CONCLUSION

The three frameworks discussed in this case study demonstrate the enabling factors and the stages that unfold in any decision to innovate change. The large range of work systems that any micro ergonomics intervention imposes on an organization requires a successful integration with all sectors to enable a successful outcome. The importance of grounding ergonomics applications in what is realistic and possible for work organizations is crucial if the ergonomist seeks to minimise the negative influences and optimise a balanced fit for the organization and the individual.

Ergonomists cannot simply provide a report with recommendations if they hope to ensure the successful implementation of micro ergonomics processes. The concept of a balanced organization highlights the importance of an ergonomist remaining involved in the process to ensure its successful integration with the overall operation of that organization. Whilst excellent solutions may be proposed in a report, the reality of implementing them may be far removed from what is possible for the work organization. Ergonomists are dealing with a complex interplay of variables within a living organizational entity. The time frames that have been necessary to complete the project have required persistence, focus and commitment from all levels over a two year period. The contribution that has been necessary from a range of personnel with different expertise is also considerable.

This study shows that companies can choose to balance individual and organizational health issues with a focus on the rational economic factors. A considerable allocation of funds and staff resources has been dedicated to improving the work systems within this organization. According to Carayon and Smith (2000), when areas of negative attribute have been identified they can frequently be offset by something else. Throughout this case study, the constant balancing of factors has been a conscious and continual process of evolution that has taken place throughout the entire implementation phase. Communication between all parties has been vital since a change in one work system influences another work system within the network. Despite the commitment to this approach, there were occasional breakdowns during this process as discussed in the sections about frameworks. In addition,

traditional concepts of macroergonomics being a top-down process would not appear to be reflected in this case study. Both top down and bottom up approaches have been observed and were necessarily incorporated for a successful outcome.

In examining the outcomes that this work organization has achieved there have been both objective and subjective performance improvements. Both must be achieved in a business environment to create and maintain a healthy organization. Measurable components such as improved annual income turnover (33%); overall production (33%); croissant output (17%); reduction in waste (2%); new markets (33%); and reduction in staff turnover (6% to 2.5%) were tabled. Subjective reports noted cultural improvements, greater equity, empowerment, innovation, communication, improved awareness and understanding. These improvements cannot be pin-pointed to one particular factor but rather to the sum of the parts being greater than or equal to the whole.

Frameworks provide a conceptual structure for identifying the more obvious forces on an organization. Objective measures provide a visual format for the outcomes of interventions. What is difficult to capture is the subtle changing face of the organization and the relevant ingredients for success such as the move towards empowering all levels of the organization; promoting a culture of participation; creating and dispersing knowledge through multiple sectors and individuals in the organization; and utilising external knowledge gained from consultants for internal affect. It is these unique and not easily measured components that would also appear to be part of this particular work organization's identity and constitution. It may be beneficial for ergonomists to understand that in order to embed interventions in organizations it is necessary to explore concepts of knowledge creation, innovation and open work systems as discussed by people such as Nonaka and Takeuchi (1995). Organizational knowledge creation is the "capability of a company as a whole to create new knowledge, disseminate it throughout the organization and embody it in products, services and systems." (Nonaka and Takeuchi, 1995) In the new economy, continuous improvement occurs when knowledge is brought in from outside the company, shared widely within the company, stored within their knowledge base and utilised to develop technologies and products for competitive advantage. The process of knowledge creation and organizational learning are seen as a continuous spiral of converting knowledge from outside to inside the company.

In this case study, a process of conversion was observed, where knowledge was extracted from a range of sources, both internal and external to the company. This knowledge appeared to have progressed from something that was explicit to something that was tacit and internalised by a range of key people in the development team and embedded in their work systems. A level of individual competence and knowledge appeared to be developed before the group could move forward as a whole with a collective level of competence and knowledge. New technologies and products were developed during this process, but their details are subject to commercial in confidence requirements.

An ergonomist has a responsibility to not only consult, but also to assist individuals and organizations to ensure that the overall outcome of an intervention is ergonomically satisfactory. Ergonomists need to be part of work teams and part of the knowledge creation that is generated by the process of implementation. When ergonomists share their knowledge and learn from their customers, everyone develops and expands the known possibilities. Only then will innovation be possible and a successful outcome that fits an organization be achieved.

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# Book Review

Verna Blewett

## Increasing productivity and profit through health & safety

### The financial returns from a safe working environment.

2nd Edition (2004) Maurice Oxenburgh, Pepe Marlow and Andrew Oxenburgh. CRC Press. ISBN 041523319 Pub Date: 23/01/2004 Hardbound Price AUD79.95

"More ergonomics!" is the starting point for the revised, second edition of this work. This is a book for ergonomists and OHS practitioners and provides another tool (The Productivity Assessment Tool) for use in difficult circumstances. The Tool is based on the premise that "good ergonomics is good economics". Its aim is to "convince otherwise sceptical management that the value of *people* must not be underestimated and that workers are the key to their profit" (original emphasis). The Tool the authors offer to achieve this aim was developed in response to a body of work in the literature (and discussed in the Introduction) that identifies cost-benefits as a result of ergonomics interventions using a variety of methods. The authors note that there are significant disadvantages in using engineering-based cost-benefit analyses that rely on costing technology or process to the exclusion of human costs or benefits, with the exception of direct wages. A generic model that incorporates ergonomics data and made available to all enterprises, would, the authors suggest, be a valuable tool for OHS practitioners that would provide them with the necessary data to convince management to spend money on improvements in the workplace – hence the Tool.

In the penultimate chapter, "Ethics", the first author, Maurice Oxenburgh, holds a conversation with the reader that sets out to dispel concerns that this book might advocate a "safety pays" message [despite the catch-phrase quoted above], or that a positive cost-benefit is both necessary and sufficient for workplace intervention to take place. Indeed, in reading the book I was constantly confronted with the concern that the approach advocates an emphasis on financial gain to the exclusion of other motivations for ergonomics interventions. He expands the discussion to the ethical basis for various professional societies' codes of practice and the way they apply to the practice of ergonomists and other OHS professionals. It's a discussion worth having, but I suspect there are better places to have it. That said, it's a pity that the early part of this chapter is not stated up-front in the book in a chapter called "Handle with care" (or similar). In explaining the ethical considerations Dr Oxenburgh is not apologetic or defensive; he describes the limitations of the approach advocated in the book and sets a context for considered use of the Tool. It would have quietened some of my concerns if I had read it first. There is further useful introductory material in the opening to Chapter 5, "Case studies" which could also be incorporated in a preliminary chapter. This justifies the use of the Tool in today's market economy with its emphasis on short-term economics and the trend towards self-regulation.

Instead, Chapter Two presents "economics for non-economists". This is a neat introduction to the snake-oil language of economics that clearly describes its inexact nature, describes where it's likely to fail the user and how it might be used to best advantage as a decision-making tool. I would like to have had access to this when I studied economics as part of my MBA!

The theory behind the Tool is not intellectually demanding, but it can be complex in its application. Therefore, the book is accompanied by a CD of the software, *productAbility Basic*. (Details on how to obtain the complete version, *productAbility*, are in the book in case you want the bigger program, or the CD is missing or damaged.) Using the software the reader can plug numbers into the Tool proposed in the book. Refreshingly, the authors go to pains to advise that this is neither the only Tool, nor the only software that can be used. They invite users to use the Tool "intelligently" and adapt it as needed. The software can only be installed on Windows 95, 98, 2000, XP and NT 4.0. Like many ergonomists, I choose to use the very user-friendly Macintosh system, thus I was unable to load and test the software that accompanies the book, so can't tell you how it works or doesn't work. The book works on the premise that you have the software and will be entering data from the case studies in the book, or from your own examples – in fact a significant part of the book is described as a "handbook" for the software. As the authors point out, manually calculating the productivity assessment is laborious and prone to error; but it can be done. Nevertheless, Chapters 3 & 4 cover how to ask the right questions; collect useful data; and how to plug them into the Tool.

Chapter 5 is broken into sub-sections with case-studies of ergonomic interventions in both manufacturing and service industries. The usual manufacturing examples are still there (overuse injuries, manual handling, use of PPE...) but in this edition there is a wider range of cases that better represents the issues faced by contemporary OHS practitioners. For example there is a case study that involves the use of precarious employment in the hospitality industry and another on call centres. Each of the case studies provides detailed introductory information that invites the reader to consider more than the skeleton of the problem. They also serve to highlight where the model can be applied and where it cannot. They are a critical part of the book.

The layout of the book means that there are more words than are strictly necessary, but it is very easy to navigate and there is consistently good cross referencing (to remind the reader that they really do need to read sections other than the one where the book fell open) and clear referencing to the files on the CD (which I presume are accurate). Each chapter is prefaced with its own contents box and commences with a lucid "what this chapter is about" introduction. References for each chapter are included as chapter endnotes. There is a useful index, a glossary of terms and instructions on installing the software (which always seems to be necessary for not-Macs). Typographical errors, missing/unnecessary commas and apostrophes appear at about the same rate as they do in my Year 12 daughter's essays – to this reader they stand out, they are an annoyance and they interfere with reading. Perhaps I'm showing my age...



Nonetheless, if you or your management is sceptical, then this is a book that may help you work out that people in the workplace are of primary importance. Like other tools, this one will work for some people some of the time. As the authors strive to point out, it may not tell you all you need to know, but it is likely to give you information that can support your efforts. Read Chapter 7 first – it's an important introduction to another useful tool in the ergonomist's toolbox.

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## Noticeboard

### HFESA Honours and Awards 2004 Announced at HFESA Conference 2004

**Ron Cumming Memorial  
Lecture Medal** Dr Robin Burgess-Limerick

**Fellowship** Dr Verna Blewett

**Society Medal** Dr Shirleyann Gibbs

**Ken Provins Award** Mark Hennessy  
– Best Paper at Conference “Current Design Challenges”

**Alan Welford** Leon Straker  
– Best Published Paper “Evidence to support using squat, semi-squat and stoop lifting techniques to lift low lying objects”

**David Ferguson** Valerie O’Keeffe  
– Best Student Project “Risk Assessment of Repetitive Work”

**John Lane Award** R Burgess-Limerick, R Egeskov,  
– Best Ergonomics Research C Pollock, I. Straker  
“A Randomised and Controlled Trial of Participative Ergonomics for Manual Tasks” (PERforM)

**Gitte Linaard Award** TBA at the OZCHI Conference  
(CHISIG to award) Nov 2004

### NEW HFESA MEMBERS

#### August 2004

Name	State	Grade	Upgrade
ORS Group	WA	Corp	

#### September 2004

Name	State	Grade	Upgrade
Kristy Nicholson	NSW	M	
Graeme Broderick	VIC	A	
Yvonne Hinch	NSW	M	

#### October 2004

Name	State	Grade	Upgrade
Catherine De Lange	VIC	A	
Todd Bentley	VIC	M	

# CALL FOR NOMINATIONS FOR AN IEA DELEGATE

## CALL FOR NOMINATIONS for an IEA DELEGATE for the Human Factors & Ergonomics Society of Australia 2004-2006

I, \_\_\_\_\_ (proposer) wish to nominate \_\_\_\_\_ (Nominee)  
for the position of IEA Delegate for the Human Factors & Ergonomics Society of Australia Inc.

Signed: \_\_\_\_\_ (1st Proposer) Date: \_\_\_\_\_

Signed: \_\_\_\_\_ (2nd Proposer) Date: \_\_\_\_\_

I, \_\_\_\_\_ (Nominee)

Accept the nomination of the position above and declare that I am eligible to hold the position of IEA delegate for the HFESA as stated in the HFESA Constitution and rules.

Signed: \_\_\_\_\_ (nominee) Date: \_\_\_\_\_

Return to:           The Human Factors & Ergonomics Society of Australia Inc  
                          Creeda Business Centre  
                          281 Goyder Street  
                          Narrabundah ACT 2604  
                          Phone 02-6295-5959  
                          secretariat@ergonomics.org.au

**Nominations to be received no later than 15th January 2005**

**Note: Delegates are responsible for travel and accommodation expenses involved in this role.**

# Branch News

## HFESA Victorian Branch Professional Development Evening 17 August 2004

Steve Cowley BSc (OHS) MSc (OccHyg), Grad Cert Ed, FSIA, RSP travelled from Ballarat to speak with quite a bit of humour, on two connected topics arising from his near-complete PhD: **Improving the uptake of safety solutions by small business and a comparison of plasterboard plastering methods.**

How do we get small business to take up safety solutions?

Use social marketing strategies to transfer knowledge into practice, says Steve.

Compared to large business, small businesses (<20 employees) have fewer safety management resources; risk controls are less likely to suit them; and OHS generally has a lower priority, with occupational disease less recognised. With less formal OHS knowledge, the small business is more likely to blame worker carelessness for events. Small business also tends to believe its chemical materials are quite safe because "they wouldn't be sold anything that is dangerous".

### Influencing Behavioural Change

Mail-outs of safety information tend not to be read, billboards with safety messages are useful but have only short-term effects and commercial marketing, while raising awareness, is insufficient to bring about behavioural change. Small business indicates it prefers prescriptive measures rather than self-regulation as it saves time and effort.

**Social marketing** is the application of commercial marketing techniques to influence behaviour. Examples of social marketing are the anti-smoking campaign, road safety and heart disease. The marketing strategies of awareness raising and establishing a positive image need the additional input of social factors such as reasons why employees might not follow safety regulations.

### Fishers and PFDs

As an example, commercial **fishers** (formerly referred to as fishermen!) refuse to wear life jackets (personal flotation devices or PFDs) due to the bulkiness of the PFD preventing them from performing their work efficiently. Research found that none of the available PFDs was suitable and several modifications have been tested to achieve a satisfactory model.

### Plastering

Another the example is the **plasterer** (not formerly referred to as plastermen!). Plasterers generally operate as small businesses and the plastering industry experiences mostly manual handling injuries due to handling 6m lengths of plasterboard. They also experience 20 times the average rate of falls from <2m heights which is due to falls off trestles when plastering ceilings. Where conditions are suitable, the use of stilts reduces the need for trestles but stilts are still controversial.

There is a device known as a **trowel box** that is a metal box containing the plaster adhesive positioned on a long pole. The adhesive seals the joints of the plasterboards on ceilings and it can be dispensed while walking along the floor. The box is used extensively in the USA but in Australia the unions ban them owing to a perceived risk of injury. Steve made a comparative study of neck, shoulder and low back postures during conventional trowelling on a trestle, trowelling on stilts and box trowelling. His research carried out with ten subjects, showed a huge variation in technique. In comparing hand trowelling and box trowelling, he found that during box trowelling:

- (a) shoulder angles were the same;
- (b) trunk lateral flexion was more;
- (c) neck extension was more;
- (d) lumbar extension was less; and
- (e) perceived exertion was 22% less.

His conclusion was that where a good technique was used, risk is reduced and he will use these findings to persuade the plastering industry that the box trowel is safe to use.

Steve calls this type of research "action research" ie testing ideas to get evidence proving the efficacy of a recommendation.

*Jacquie Wissenden*

## NEW AUSTRALIAN BOOK ON INJURY PREVENTION

The Scientific Basis of Injury Prevention and Control  
Edited by Rod McClure, Mark Stevenson and Suzanne McEvoy  
Just published by IP Communications, Melbourne  
For details, including how to order, see publisher's website:  
[www.ipcommunications.com.au](http://www.ipcommunications.com.au)

*Robin Burgess-Limerick PhD*  
[robin@hms.uq.edu.au](mailto:robin@hms.uq.edu.au)

## INTERNATIONAL CONFERENCE ON COMPUTER-AIDED ERGONOMICS AND SAFETY - CAES 2005

25-28 May 2005

Kosice, Slovak Republic

Dear colleague,

On behalf of the Technical University of Kosice, Slovak Republic and the International Ergonomics Association, I cordially invite you to participate at the CAES 2005 – the International Conference on Computer-Aided Ergonomics and Safety. The CAES Conference is periodically one of the most important international forums for the exchange of ergonomics research and practices. It is a great honour for us, i. e. for the Technical University of Kosice, for the Kosice City as well as for the Slovak Republic, to have this excellent and unique opportunity to present our university, our nice city and country, too, in this way.

The CAES 2005 is being held in Slovakia, i.e. in the Middle-East European region. Therefore, it will be a suitable opportunity for ergonomic and safety researchers from the Middle- and East-European countries to share and exchange the newest scientific information with our worldwide friends from this branch of science. We would like to emphasize that this conference is being organized in a close cooperation with the Center of Industrial Ergonomics, University of Louisville, USA - namely with the working team of Prof. Karwowski.

**For all necessary information and following steps, please, visit the official web site of CAES 2005 conference:**  
<http://www.tuke.sk/caes/>

Please, remember that abstract submission deadline is **15 January 2005**.

Finally, I would like to express my gratefulness to Prof. Waldemar Karwowski for the idea and suggestion to organize the CAES 2005 in Kosice.

See you in Kosice next year.

Prof. Juraj SINAY  
CAES Chairman

**Organizational committee:**  
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## CALL FOR PAPERS

### Meeting Diversity in Cyber/Online Ergonomics

#### Invitation to Participate

You are cordially invited to participate in the 4th International Cyberspace Conference on Ergonomics, CybErg 2005 held in conjunction with Cibergero 2005 (the Spanish-speaking ergonomics conference). This conference, CybErg 2005, is an online (virtual) conference on Ergonomics and Human Computer Interaction.

**Conference Dates: 15 September to 15 October 2005.**

#### Costs

Early-bird registration (before 1 July 2005): US\$100  
Later registration (after 1 July 2005): US\$130

Registration includes a CD-Rom copy of the proceedings and participation in all online sessions (and of course all your travel "expenses")

**Registration discounts (US\$60)** are available for participants from Industrially Developing Countries and for full time registered students.

#### How to find out more and register

<http://cyberg.wits.ac.za/>

or e-mail Dr Andrew Thatcher:

[cyberg2005@umthombo.wits.ac.za](mailto:cyberg2005@umthombo.wits.ac.za)

Tel: +27 11 717 4533

Fax: +27 11 717 4559

Dr Andrew Thatcher

Discipline of Psychology, School of Human & Community

Development University of the Witwatersrand, WITS, South Africa

### International Occupational Hygiene Association (IOHA) 6th International Scientific Conference, 19-23 September 2005, Pilanesberg National Park, South Africa (IOHA 2005)

Scientific Sessions/Papers:

Agriculture; Asbestos; Biological Monitoring; Chemical Agents including Agrochemicals and Pesticides; Communications and Information Technology; Environmental Issues/Management; Ergonomics; Exposure Assessment Strategies; Gender; Human Behaviour, Shiftwork and Stress Management; Informal Sector; Manufacturing; Mining; National Exposure Databases; New Developments in Occupational Hygiene; Occupational Health and Safety (OHS) Management Systems; Personal Protective Equipment (PPE); Physical Agents - Heat and Lighting; Noise and Vibration; Silicosis.

<http://www.saioh.org/ioha2005/Papers.htm>

IOHA 2005 - Networking, Scientific Papers, Professional Development, Current Issues, Poster Sessions, Exhibition, 3rd International Control Banding Workshop (3ICBW), Industry Visits, Accompanying Persons Programme, an "Out of Africa Experience" .....

We look forward to your support.

David. W. Stanton

For IOHA 2005 <http://www.saioh.org/ioha2005/>



# Conference Calendar

## 2005

21-24 March 2005, New Orleans, Louisiana, USA  
8th Annual Applied Ergonomics Conference: Real World.  
Real People. Real Results.

Hyatt Regency, New Orleans, LA  
URL: <http://appliedergonetw.iienet.org/conference>  
Tel: +1 800 494-0460, +1 770 449-0460  
e-mail: [cs@iienet.org](mailto:cs@iienet.org)  
Institute of Industrial Engineers  
3577 Parkway Lane  
Suite 200  
Norcross, GA 30092

### 30 March - 2 April 2005

International Conference - HEPS 2005 - Healthcare systems  
Ergonomics and Patient Safety Florence, Italy  
[www.heps2005.org](http://www.heps2005.org)

24-27 May 2005 – Gerontechnology 2005  
The International Society for Gerontechnology  
Nagoya, Japan

25-28 May 2005 – CAES 2005  
International conference on computer-aided ergonomics  
and safety  
Kosice, Slovak Republic  
<http://www.tuke.sk/caes/>  
Organizational committee:  
Dipl.-Ing. Zuzana Lavrinova  
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Dipl.-Ing. Melichar Kopas  
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### 7 - 9 June 2005 – 3rd International Conference on Whole-Body Vibration Injuries

Contacts:  
Scientific secretariat  
Patrice Donati  
Institut National de Recherche et de Securite  
Ingenierie des Equipements de Travail  
email: [wbv2005@inrs.fr](mailto:wbv2005@inrs.fr)  
Tel: +33 3 83 50 20 49  
Fax: +33 3 83 50 21 03

#### Registration

Secretariat Congress WBV 2005  
Lorraine Congres  
BP 663  
54063 Nancy Cedex France  
email: [ma@nancy-congress.com](mailto:ma@nancy-congress.com)  
Tel: +33 3 83 36 81 81  
Fax: +33 3 83 36 81 80

22-27 July 2005 – HCI International 2005  
11th International Conference on Human-Computer Interaction  
Caesar's Palace, Las Vegas, USA  
Internet: [www.hcii2005.engr.wisc.edu](http://www.hcii2005.engr.wisc.edu)

1-30 September 2005 – Cyberg 2005  
Fourth International Cyberspace Conference on Ergonomics  
Internet: [www.cyberg.wits.ac.za](http://www.cyberg.wits.ac.za)

19-23 September 2005 – International Occupational Hygiene  
Association (IOHA) 6th International Scientific Conference,  
Pilanesberg National Park, South Africa (IOHA 2005)  
Internet: [www.saioh.org/ioha2005/](http://www.saioh.org/ioha2005/)

21-23 November 2005 – 41st Annual Conference of the HFESA  
"Technology Improving Performance"  
Canberra, ACT, Australia  
Contact: HFESA Secretariat  
Email: [secretariat@ergonomics.org.au](mailto:secretariat@ergonomics.org.au)

## 2006

30 March - 2 April 2005  
International Conference - HEPS 2005 - Healthcare systems  
Ergonomics and Patient Safety  
Florence, Italy  
[www.heps2005.org](http://www.heps2005.org)

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](http://www.icoh.org.sg)

10 - 14 July 2006 – IEA 16th Triennial Congress – Meeting  
Diversity in Ergonomics  
MECC Congress Centre, Maastricht, The Netherlands  
Conference Website: [www.iea2006.org](http://www.iea2006.org)  
Contact: Ernst AP Koningsveld  
Congress Chairman  
E: [nvve@planet.nl](mailto:nvve@planet.nl)

## 2007

21-24 May 2007 – WWCS2007  
Work with Computer Systems – Computer systems  
for human benefits Stockholm, Sweden  
Internet: [www.wwcs2007.se](http://www.wwcs2007.se)

# Information for Contributors

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

## Editor

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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 advertising inquiries should be directed to the National Secretariat of the Society.

## Contact

Ms Jennifer Allen  
T: 02 6295 5959 Fax: 02 6295 5946 E-mail:  
secretariat@ergonomics.org.au  
9.00 pm – 5.00 pm Monday and Wednesday  
12.30pm – 5.00 pm Friday

## Size

The finished page size of the Journal 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

## Rates for Advertising

These rates are inclusive of GST

	Full page	1/2 page	1/4 page	1/8 page
Single issue	\$ 330	165	82.50	41.80
2 issues	\$ 297	148.50	74.80	37.40
3 issues	\$ 264	132	66	33
4 or more	\$ 231	115.50	58.30	29.70

## 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

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.  
 Creeda Business Centre  
 281 Goyder Street  
 Narrabundah ACT 2604

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

<b>Edition</b>	<b>Submission Deadline</b>
March	February 1
June	May 1
September	August 1
December	November 1

**Circulation**

The Journal is published four times a year and is received by approximately 620 professionals Australia wide working in the areas of ergonomics, occupational health and safety, and design.

**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.

**Caveats**

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

The ESA 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.

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