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Editorial

Apologies for the tardy appearance of this issue - blame this one on the editor having a poorly timed, but highly valued, holiday. Items of interest within include news from Federal Council and IEA, a summary of introducing newbies to Ergonomics on the Web, and a report from IEA `97. I have also included an abbreviated version of my half yearly report on Ergonomics Australia to council. Professional development items include a paper summarising health issues arising from the use of Virtual Reality Displays, a case study on the Ergonomics of Forklifts designed for use with students, a guide to the use of help files for on-line Health & Safety information by David Brown, and the usual assortment of electronic tit bits. Thanks to all contributors. Feedback, suggestions, and especially contributions, are always welcome.

Best wishes to all,
Robin Burgess-Limerick
Email: robin@hms.uq.edu.au

ps., this year's conference is shaping up to be a big one - see you there.

ESA Council News
The Council met by teleconference on 21 July. Following are the main decisions taken.

**Special Interest Groups:** In the light of replies from SIG Convenors, Council annulled all existing SIGs except CHISIG, COGSIG and SBESIG and agreed to monitor the prospects for other SIGs and Networks after the membership returns were analysed.

**Continuing Education for Ergonomists:** Council agreed to apply for funds from the OH&S Trust to mount a program of continuing education for ergonomists.

**Incoming Executive:** The following names were endorsed and will be recommended to the membership:

- President-elect: David Caple
- General Secretary-elect: Tony Payne
- Treasurer-elect: Ros Kushinsky.

**Changes to Constitution:** Council resolved to recommend to the membership that the name of the "Council" be changed to that of a "Board" and that the name of "Councillors" be changed to those of "Directors".

**Nominees to Outside Bodies:** Draft Guidelines for the nomination of members to outside bodies such as Standards Australia committees were discussed. Copies of the draft are be distributed to all Branches and Councillors in order that they suggest refinements before the next (September) Council meeting.

**Competencies:** Jim Carmichael (Convenor of sub-committee) reported that there was to be another meeting of Standing Committee on 14 September in Melbourne for finalisation of the standards.

**Logo:** Christine Aickin reported that a NSW committee had reduced the number of entries from 30 to 3 and then asked the designers of those three to further improve on them. The improved designs should be available for Council's September meeting.

**OH&S Auditors Certification:** It was reported that the Executive saw possibilities for the ESA to develop good quality auditor training and possibly to receive further funding. Christine Aickin and Ian Mitchell were to confer soon to work out some principles and to report to the Executive.

**Homepage Update:** Leon Straker advised Council that the revised ESA www pages are at [http://www.curtin.edu.au/society/esa/](http://www.curtin.edu.au/society/esa/)

**NSW Donation:** NSW announced that the $5000 loan given to assist the Society at the end of last year, was to be donated - with the hope that the monies be used for the competencies project.

**Copyright of Conference Papers:** Council discussed the possibility of copyrighting papers presented to the Annual Conferences. The draft was accepted for distribution to Branches for any further comment.
IEA Presidency: The President announced that Margaret Bullock narrowly lost the election as the next IEA President.

Please note that phone number for the federal secretariat has changed to: (02) 6242 1951 and fax (02) 6241 2554.

Editor's Report

Robin Burgess-Limerick

The following is an abbreviate version of the editor's half yearly report to council. I will be happy to provide the complete version to any member who is interested.

I replaced Ross Armstrong as Editor of Ergonomics Australia from the beginning of calendar year 1997. I am pleased to provide council with this report on the first 6 months of my tenure, an accompanying financial report for FY96/97, and a proposed budget for FY97/98.

Three issues (February, April, and June) have been produced. As I described in my first editorial, I propose to enhance the professional development role of the journal while maintaining its communication function. I have been moderately pleased with the progress towards this aim. The April and June issues in particular have contained articles on topics relevant to members, and additional items are in the pipeline for August and October issues. I have, however, been a little disappointed by the lack of submissions of this type from ESA members, and especially certified professional members. I seem to have more success soliciting material from non-members. I shall continue to solicit material from members and hope to have more success in the future (I suspect people will be trying to avoid me at this years conference!).

Editorial Advisory Committee

An Editorial Advisory Committee is in the process of being formed. Ian Gibson has been nominated by council. I have nominated Shann Gibbs (NSW, who has accepted the nomination) and a second person who, after some discussion, declined. I hope to nominate and secure the involvement of a second person in the near future, however I would be interested in any suggestions which council might have for a nominee who would, as far as possible, balance the gender, geographical location, and areas of expertise of myself, Ian, and Shann; and who is readily able to communicate with other EAC members via email.

Ergonomics Australia On-Line

All 1997 issues of Ergonomics Australia have been simultaneously made available via public access web server located at The University of Queensland. As outlined in my first editorial, I view this step as beneficial for a number of reasons which I will not reiterate here. The April and June issues of the electronic version contained additional professional development material which could not have been accomodated within the page restrictions of the paper version (the dead tree version as some would say). Download statistics for the index page of EAOL (see figure
below) indicate increasing popularity of these pages with both local and overseas browsers. Pending the outcome of the ESA committee examining this topic, I propose to continue publishing EAOL on a trial basis.

![Graph showing number of downloads](http://www.uq.edu.au/eaol/aug97/aug97.html)

Number of downloads of EAOL index page (http://www.uq.edu.au/eaol/) by month.

**Financial Statement and proposed Budget**

A financial statement for FY96/97 was provided to council. Total expenditure for the year was $13,224, income was $2,099; resulting in an overall cost to the ESA for the the publication of *Ergonomics Australia* of $11,125. A proposed budget for FY97/87 was also attached. Expenditure of $16,436 is anticipated, and income estimated at $3,900; resulting in an overall cost for FY97/98 of $12,536. Further details are available on request.

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**IEA Report**

Margaret I Bullock  
ESA representative to the IEA

The IEA Council met recently in Tampere, in association with the Triennial Congress, IEA ’97. At that meeting new office bearers were elected for the next three years:

President: Dr Ian Noy, Canada  
Secretary General: Prof Waldemar Karwowski, USA  
Treasurer: Dr Kazutaka Kogi, Japan

The following points may be of interest to ESA members.

**Education and Training:** Guidelines have been developed for a number of items relevant to quality assurance. These include IEA minimum criteria for certification of the ergonomist, IEA criteria for the endorsement of a certifying body, IEA core competencies for the practising ergonomist, and basic criteria for the accreditation
of an ergonomics educational program. The IEA is now circulating these guidelines to Federated Societies for their reference and comment.

It is intended that where requested to do so, the IEA will provide a system of review of processes of certification applied by individual Societies and of the structure and operation of the certifying bodies. Provided that the certification process and the certifying body meet the relevant IEA minimum criteria outlined, IEA endorsement will be recommended. Both endorsement procedures are intended to encourage the application of international standards.

The IEA outline of core competencies has been distributed as a "living document", with the expectation that it will be used immediately, but that the outline will evolve with the discipline and practice of ergonomics and as Federated Societies make further comment.

Each Federated Society is being asked to update its entry in the Directory of Ergonomics Education Programs, which is now accessible via the IEA Home-page. Any updated material on educational programs which award a qualification in ergonomics must first be endorsed by the relevant national Society before electronic transfer to the Directory. A new feature of this arrangement is that if details of a particular program are available (such as curricula or application forms for enrolment), a link with the IEA home page may be made available.

**Technical Group activity:** During 1994 - 97, IEA sponsored 17 conferences around the world, many of which were held in industrially developing countries.

The IEA Technical Groups helped by organising paper sessions for the IEA Congress and about half of the papers presented at the IEA Congress in Tampere were sponsored by Technical Groups.

Two new Technical Groups were formed recently on an initiative of the French scientific community: Hospital ergonomics, chaired by F Daniellou, and Work Psycho-dynamics, chaired by Brun. Membership lists and action plans are still being developed and ESA members who have an interest are invited to contact the Secretary General.

**Internet activities:** Now that the IEA Web page is well established, each Federated Society is being asked to connect itself to the page. This would then become the most comprehensive Internet source of Ergonomics information available.

Home page on World Wide Web:

http://www.spd.louisville.edu/~ergonomics/iea.html
http://www.spd.louisville.edu/~ergonomics/international-ergonomics-association.html

Electronic communication tools for IEA

The COUNCIL and IEAWORLD discussion lists on the Internet are available:

- COUNCIL, to facilitate communication between the IEA and Officers of the IEA Federated Societies;
- IEAWORLD, to facilitate information exchange between IEA members and the ergonomics community world wide.

In order to subscribe to the IEAWORLD, send a request message as follows:

<send to> LISTSERV@ULKYM.LOUISVILLE.EDU
<subject> (leave the subject line blank)
SUBIEAWORLD First-name Last-name

The IEA congratulated the ESA on its successful introduction of the CybErg Conference and supported the continuation of this initiative on a triennial basis.

The IEA Press has been established to publish IEA sponsored Conferences Proceedings, materials generated by Technical Committees of the Science and Technology Committee, and other IEA Reports and material. The IEA Press does not engage in any commercial printing activities or publishing of projects which require significant investment of IEA funds.

The IEA Journal of Ergonomics and Human Factors: Research and Applications will appear as a refereed Web Journal, to make information available with minimum cost. The WWW site is maintained by Prof M Mattila at Tampere University of Technology, Tampere, Finland. Available to subscribers who pay a small subscription fee, this Journal will be free to members of IEA Federated Societies within industrially developing countries. The first issue is planned for publication in the second part of 1997.

Prizes: A new prize has been established by the Liberty Mutual Group in collaboration with the IEA. The annual prize of $US5,000 will be awarded for an original contribution leading to a better understanding of avoiding, or mitigating occupational accidents and injuries, or in rehabilitation and return to work of an injured worker. Applicants will submit an original report of laboratory, field or intervention research within the field of ergonomics and occupational safety and health. In addition, each three years, a prize of $US15,000 will be awarded to the most significant of the three reports from the previous three years.

New membership: The Turkish Ergonomics Society has been accepted for Federated Membership of the IEA.

Branch News

Victoria

The following is a summary of a recent Victorian Branch presentation

Ergonomics Resources on the Web

Owen Evans, Associate Professor in Ergonomics
This session doesn't assume any previous knowledge of the Internet, but aims to accommodate people with different levels of familiarity.

The aim is to make you aware of some of the relevant material that is available, and how to access it. To this end, I have prepared a list of sites, and created a page of them that you can access now (or at any later time). Do not try to look at everything, but be selective about what might be of most interest and value to you. The listing is by no means exhaustive - if you search for "ergonomics" on the web, you'll get hundreds of thousands of "hits".

As more information is presented (of all qualities) the name of the game is sorting the gold from the dross. When I last checked (17 April 1997) about 85% of sites listed were accessible - don't be surprised if you have some failures.

If you feel that you are already familiar with WWW, just skim the attached pages, and go directly to "Owen Evans's Bookmarks" at http://luff.latrobe.edu.au/~lhsome/startbkmks.html.

You may also wish to try the sites listed below, which are additional to those on the "bookmarks" page.

If you are uncertain of your ability to navigate the World Wide Web, I suggest that you work your way through the attached pages (and if you have time also look at some of the sites listed below).

Some additional sites not included (yet) in Owen Evans' Bookmarks are:

http://www.nt.gov.au/wha - NT Work Health Authority
http://www.hsha.gov/ - US Dol Mine Safety and Health Authority
http://www.ccohs.ca - Canadian Center for OHS
http://turva.me.tut.fi/cis/home.html - ILO-CIS

or, if you want a quick way to light a barbecue, try http://ghg.ecn.purdue.edu/

Getting started on the World-Wide Web

We will concentrate today only on part of the Internet, the World-Wide-Web (WWW), using the most common browser program, Netscape (the other main browser program is Microsoft Internet Explorer). The WWW or web is the most
talked about and currently development part of the Internet (but the two are not synonymous).

If you decide that you want to get your own connection to the Internet and the WWW, please try to find a retailer or service provide who will be able to help you get set up initially. It is this initial phase which is the most frustrating. Please note that computer accounts that enable access to the Internet will be registered for all enrolled students, so keep in touch.

Anything that appears in these notes is likely to be out of date tomorrow or next month, so exploration rather than prescription is the name of the game. When I updated these notes from nine months ago, about a quarter of the sites in my bookmarks (see later) had to be changed in some way.

The WWW is made up of a number of pages, linked by Hypertext links (highlighted text or objects). You point the mouse to the link and click. A link might take you to another part of the same page, to another page on the same computer, or equally, to a page on a computer on the other side of the world. Note that the web is very volatile, so it is not uncommon for pages to be unavailable, moved or missing.

A page may have, in addition to text pictures, sounds, even movies, included in it. These elements take a long time to shift around the net, so Netscape allows the option of deferring loading of these elements in order to speed things up. (From the Optiions menu click Auto Load Images if it is already ticked, then when you do want images, click Images in Netscape's toolbar, or click on the images placeholder for an individual image. Sometime the page needs the images in order to make sense.

Some pages are essentially just lists of links to other pages. The Biomechanics World Wide page is an example, as is my own set of links discussed later.

Getting Started. If Netscape is not currently running, go through the steps in the Appendix to get started. When Netscape is started, it probably went straight to the La Trobe University Home Page. If not: Click the Open button, and type in http://www.latrobe.edu.au? and press <return>

This gives you some links to both local remote pages. Feel free to explore any of these. Of particular interest is Bookmarks (on the left of the screen, not to be confused with BOOKMARKS in the menu bar) which points you in the direction off some useful search tools as well as some local items of interest. In particular, not the Alta Vista. Yahoo and other search engines at the left. These allows you to search for items of interest. Each work a little differently, so it is worth exploring each. Also on this page (you will need to scroll down to the foot of the page) are useful links to various documents that help you in getting connected at La Trobe. Also through here you can access the library catalog (and indirectly, those of other institutions)

For the moment, open (click on Open in Netscape's toolbar, and type in) the location.
http://www.spd.louisville.edu/~ergonomics/international_ergonomics-association.html

This is the home page of the International Ergonomics Association. This is quite a large page with images, so many take some time to load. Follow a link or two of your own interest. Note that the tilde character, "~", which crops up often, is found at the top left of the keyboard.

Going back - You can always go back to places you have already visited (that's the jargon) by clicking the Back button (top left). Another way to revisit places that you've already been to in this session is by pulling down the Go menu.

This shows a list of places you've visited, and you can select any one of them. Select the La Trobe Home Page now. Another way to get to the page that you first saw is to click on Home in Netscape's Toolbar.

Searching - There are several "search engines" available, and some of these are accessible through the bookmarks link from the LTU Home Page. Select it now, and select Alta Vista. Click in the blank space, and enter ergonomics as the search string, and click Submit button. Alta Vista is very fast and generates a lot of "hits", but tends to be a bit non-discriminating.

You can directly go to any of the pages found by clicking on their Links.

Go Back to the Bookmarks page and select Yahoo. This is another search tool. Try it out with "human factors" (including the inverted commas) as the search string.

Bookmarks - The Bookmarks menu gives you a way of storing places for subsequent visits. Normally, you would use this to save Bookmarks of your own (Use the Bookmarks menu, Add Bookmark) for later use. To make things easy for you, I've made my own bookmarks available to you, and saved it on the WWW itself. Click Open, and type in: http://luff.latrobe.edu.au/~lhsome/Startbkmks.html and hit <return>

Try ERGOWEB (hint: under Ergonomics), an important site maintained at the University of Utah. Also useful are the sites listed in Ergonomics Links and Indexes.

Fun - All work and no play ..

Check out the Lonely Planet online (listed under Australian in my bookmark site).

. Or click the What's Cool? button

. Or if you are into Land Rovers, check out the Automotive heading in my bookmarks.

. Try the search process on your own topics of interest.

. Or click the Surprise button in Alta Vista

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Conference Update
Productivity, Ergonomics and Safety: The Total Package.

International Occupational Health and Safety Forum and 33rd Ergonomics Society of Australia Conference

Gold Coast, Queensland, 24-27 November

This year's conference is shaping up as a feast. As of the end of July the scientific committee has accepted in excess of 70 abstracts, tentatively allocated to the following streams.

OH&S
Manual Handling
Musculoskeletal Injury
Product Design & Useability
Assessment and Interventions
Cognitive & Psychosocial
Work Design
Participatory Ergonomics
Slips and Falls

A draft program should be complete by the time you read this. For more information contact the conference organisers:

Conference Secretariat, PO Box 177, RED HILL QLD 4059 AUSTRALIA
tel: 07 3368 2644 (international callers: + 61 7 3368 2644), Freecall: 1 800 811 510 (Australian callers from outside Brisbane only), Facsimile: 07 3369 3731 (international callers: + 61 7 3369 3731), e-mail: carillon@ozemail.com.au

http://www.carrillon.com.au

Grapevine

IEA report from roving reporter Margaret Head

IEA'97 was the first international conference I have attended. It was held in Finland and it was summer. The temperature was mostly over 30 degrees Celsius and there was no air conditioning in many of the buildings. The people of Tampere were very generous to us and frequently offered me mineral water when I went into shops (usually wet through with perspiration). One of the strangest things we had to deal with was the long hours of daylight. I would forget to go to bed and on looking at my watch, suddenly find out it was 1.30 or 2.00 am. I'd be awake again at 3.30am. Strangely though I didn't feel tired until I got home.
The welcome reception offered many culinary delights such as salmon, reindeer and strawberries by the hundreds. The Fins really know how to eat and might I include drink as well. We saw people drinking beer in side walk cafes at 8.30 in the morning. Perhaps in anticipation of a hot day. Breakfasts were wonderful too, we started with cereal, but the locals went straight for the boiled eggs then salad with cheese and ham and the most delicious bread rolls I've ever eaten. Coffee was always served with cream, the way it should be.

The keynote speeches were excellent as were most of the papers. There were twenty parallel sessions each afternoon and it was difficult moving from room to room. Consequently I was unable to get to all the presentations I had planned. I attended the rehabilitation workshop on the Sunday before the conference with Sharawan Kumar and learned so much. My overall impression of the conference is that it was a truly wonderful conference and I had many opportunities to learn and meet people whose work I had read over many years. My paper was well received and subsequently, an article about it was published in the Finnish press. Having included a cost benefit analysis of my manual handling project I was able to say that for every dollar that was spent in prevention I was able to deliver a saving of $17.50 (in round terms), it attracted a lot of attention.

I took a few photographs on the evening of the dinner and I hope some are printable. Someone called for all Australians at the dinner to be photographed together and a Japanese professor came too, so we made him an honorary Australian. There was a great feeling of friendship and mutual respect. I eagerly look forward to the next congress in San Diego in 2000 I hope to see you there too.

What's the Word for Un-Ergonomic?

Michael Patkin

(xpymp@whx.whyalla.unisa.edu.au)

I don't know whether to call it un-ergonomics, or anti-ergonomics, or reverse ergonomics, or (to be particularly faddish) re-engineered ergonomics, and the adjectives are even worse. I'll give you a couple of examples and perhaps you can suggest a generic term and even a generic definition and classification.

It's the front doorhandle at Yeltana, the thoughtfully designed nursing home for the elderly at Whyalla, South Australia. They want normally abled people to be able to open and shut it, but not the elderly inmates.

The solution has been to have the handle, an ordinary lever type, pushed UP to open instead of pressed down. The first time I went there myself a few years ago, I couldn't work it out for a while. It didn't occur to me that the notice on the door would be about this very matter, because I had never associated how to use an ordinary door-handle with special instructions for its use.

I've watched other people have the same reaction trying to open the door for the first time. I've often thought it would be great fun to alter the doorhandle at an Ergonomics conference (there - I've blown it!) and gloated in the frustrations of would be door-openers. Perhaps this is something to do at a seminar room.
somewhere.

The underlying principle is the "lock-out" and part of the standard kit of an ergonomist. Ergonomics in general is about design and human behaviour, generally making something easier but sometimes making it difficult. The median strip is a structure to keep cars on their own side and decrease the numbers of head-on collisions.

The original Apple One computer in the late 1970s had the RESET key on the keyboard right next to the shift lock. You can imagine how often it would be struck unintentionally, costing minutes or hours of work. In time I believe there were two modifications. One was to make the spring on the key much stiffer so that ordinary force wouldn't reset the machine, possibly a stiffness of 5-10 Newton (half to one kilo weight) instead of 1 N or less. The other was to re-locate the RESET key well away from the usually busy part of the keyboard.

One of the best examples I can think of is the story of The Broad Street Pump. In London in the 1850s there was an epidemic of cholera in London. A local GP, Dr. Charles Snow, thought it could be from contaminated water in the Thames, which people drew from the local pump for use in their homes. Snow removed the handle from the pump and the story goes that the cholera epidemic stopped.

I'm telling this story from memory and haven't checked my reference to this story (the delicious part of writing an unrefereed article and it could have been typhoid and not cholera, and maybe the 1860s, but I think not. I suppose it's worth checking (like the Apple 1 RESET key story) before it gets enshrined as misleadingly as the Myth of Hawthorne. However this time the validity of the principle is not way out as in the case of Hawthorne. (For those unfamiliar with this, get our "The Gold and the Garbage" from the library.

There are lots of examples of this quasi-ergonomic principle (hasn't anyone a better adjective?). A little glass window over a fire alarm, sliding covers on other controls, fences, guards, information made non-visible on a computer menu to decrease mental load and diminish errors, and more.

This seems to be a special feature of small pocket radios. I have a little Phillips, which has a slightly stiff slide switch to lock the radio in the on or off mode. My younger son visiting from Hong Kong generously gave me a lovely very small Sony radio. This has a very small recessed button which can lock the radio in the off or on mode, and also locks the waveband and the individual station. Until I worked this out, the radio would go on or go off on its own in my pocket. Earphones meant I couldn't pick this up when not listening.

Sometimes I call it the funnelling principle. Think of a perfectly round peg and a perfectly round hole the same size. Perfectly impossible to engage except for the infinitesimally likely case. Then think of tapering the peg and chamfering the hole. Problem solved, like pouring liquid into a funnel and thereby into a small hole without spilling, or like a sheep-race.

Un-ergonomic means bad, and the above mechanisms are on the side of good. So what's the word?
[Editor's note: my personal favourite un-ergonomic example is the first Power Macintosh Models (the 6100 series) which have a push button power switch just below the floppy drive. Now the greatest source of frustration for new Mac users, especially those used to Wintel machines, is how to eject a floppy. However, the correct answer is not to press the button just below the floppy drive..... The problem was fixed in subsequent models - no power switch at all. (I can absolutely vouch for this example - I'm writing this on my trusty 6100/66!). ]

Using Windows Help files for on-line health and safety guides

David Brown
(davidbrown@onaustralia.com.au)

For some years, I have been experimenting with on-line health and safety materials. Those of you with long memories may recall an article "The Design and Development of the Floppy Ergonomist" (Ergonomics Australia August 1988), in which I described my first on-line ergonomics guide. At the time I said that "in a future edition I hope to include graphics but this will be a substantially more complex program."

By turning The Floppy Ergonomist into a Windows Help file, the task turned out to be far easier than I thought - in fact it is so easy that other ergonomists might want to put procedures into Help file format for their clients. As I found out, it is easy to get too complicated, so here is a quick guide to producing a simple product.

What is a Windows Help file?

Every Windows word processor and most other Windows programs have a Help file. The name of a Windows Help files ends in ".hlp", for instance "stress31.hlp".

From within a program such as Microsoft Word you invoke the associated Help file by pressing F1, or by clicking on Help, but you can also run it independently by finding the file in your Program Manager or Windows Explorer, and double clicking its icon.

A typical Windows Help file consists of a series of topics with text, graphics, hypertext links, and a keyword list. The hypertext links allow the user to move between topics by clicking on "hot spots". The keywords allow the user to look up a topic in an index.

When you display Help, you are using Microsoft's Windows help file reader. There are two current versions of the reader:

Winhelp 3 (file name winhelp.exe) runs under 16 bit Windows, that is, Windows 3.1, 3.11, Windows for Workgroups, and Win OS/2. A version of Winhelp 3 is used on the Macintosh for providing help with Microsoft applications, so you can fairly easily convert your Help file to run on a Macintosh.
Winhelp 4 (filename winhelp32.exe) runs under the 32 bit operating systems Windows 95 and Windows NT. It can also run under Win32 (a 32 bit extension to Windows 3.1), but you have to install Winhelp32 yourself to achieve that.

Winhelp 4 supports all of Winhelp 3's macros and can read a Winhelp 3 file, but not vice versa - Windows 3.1 cannot even open a Winhelp 4 file.

Microsoft has said that there will not be a Winhelp 5, instead the next version of Windows Help will be an HTML version.

**Why use a Help file rather than another multimedia format?**

There are many multimedia authoring tools which create visually appealing presentations, but there are four good reasons for using a Help file instead:

Speed. Help files run very quickly. Even across a network they are almost instant. The Help file is small, the Help engine is usually on the local computer, and only the topic that you are viewing is loaded across the network.

Most Help files easily meet the response times suggested by Engel and Granda (1975) of under 3 seconds to initialise and under 2 seconds to turn a page. For instance, my new Pocket Ergonomist takes under 2 seconds to load and under 0.5 seconds to turn the page when running across a network, and is too quick to measure if run directly from a hard disc. By comparison, the new 3M ergonomics information package takes 20 seconds to load and 18 seconds to turn the page when running from hard disc. There is a tendency in jazzy presentations such as 3M's and IBM's to make the user wait while words slowly appear on the screen in sparkling writing as if painted with a magic wand - an interesting technical achievement, but a negative instructional value!

Compatibility. By adopting a standard Windows Help file format, compatibility problems do not arise, because you are not installing a program.

Ease of installation. Only one icon needs to be installed on each workstation, and one file on the file server. No changes are made to Windows system files.

Size. In Help file format, one floppy disc fits a large amount of text and graphics, making it easy to distribute. Because a Help file takes up so little room on a hard disc people are less likely to delete it.

**Recent thinking about on-line help**


Prior to the release of Windows 95, Microsoft conducted significant research into their Windows 3.1 Help product. As a result there are a number of extra features in Winhelp 4, however the most important changes are simply changes in thinking about how help should be presented. These changes can be implemented in Winhelp 3 projects.
One of the most interesting changes is a huge reduction in the number of hypertext links within topics. Whereas early hypertext documents consisted of a massive (and often confusing) web of inter-relationships, with the concept that the user creates their own structure through the associations they choose, the new Help file format is far more structured. To compensate for the loss of connections, full text indexing is provided, along with more flexible keyword searches.

**What Microsoft says about Help files**

These few short extracts from Microsoft Windows 95 Help Authoring Kit, Microsoft Press, 1995, do not break any new ground in the theory of procedure writing, but do show that Microsoft is looking at the human factors involved. They also give a starting point for the help author to create their own "Style manual".

Task-based topics: "When creating a list of tasks to document...ask "what does the user want to achieve?" Consider the questions a user would ask when something goes wrong, and write procedures that solve those problems.

"Start titles with the infinitive form of the verb. The wording should reflect why the user would want to perform the task. For example, instead of a title such as "To use the Find command," use "To find a file or folder."

"Limit topic titles to no more than two lines. This guideline is based on viewing our procedures on a 640 x 480 screen resolution.

Minimalist writing style: "Do not include any text between a topic title and the first step of a procedure. If there is conceptual or introductory text that you must provide, consider putting it in a Tip or Note at the end of the procedure, or in a separate topic with a jump to the procedure...

Teach only one method: "We have found that people don't necessarily want a lot of choices when they open a Help topic. They just want to get a task done.

Topic size and scope: "Include only one procedure per topic. If two procedures are related, link them with a Related Topics jump. Keep procedures to as few steps as possible, making topics short enough so that the user does not have to scroll.

Related topics: "We include the Related Topics button only when a topic is closely related or is required for completing the current task."

It is not necessary to adopt all of Microsoft's guidelines - they are meant for Microsoft application help (Word, etc) rather than for on-line reference works. The book by Mary Deaton and Cheryl Zubak gives a broader view, showing the difference between different types of on-line documents. Perhaps their best concept is "layered help", the idea that the basic Help topic is simple, but that interested users can click on aspects of the topic for more detail (eg for definitions of words used).

It is important to write a formal specification as to how your product will look and operate. For instance, have a standard size (or a small number of sizes) for graphics, and stick to it, otherwise you will be forever going back to the graphic and expanding or reducing it.
Authoring software - I use a product called "ForeHelp". I also have but do not use an excellent Australian product called "HDK". If I was producing long on-line help documents from existing word processing files I would use HDK, but for a short Help file (a few hundred topics) I find Forehelp terrific.

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Case Study - Ergonomics of Forklifts

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These materials were prepared with support from the Tertiary Education Institute of the University of Queensland and the Australian Occupational Health & Safety Trust and are designed for use with advanced undergraduate students. Copyright remains with the authors. Permission is given to use these materials for non-profit educational purposes provided the source is acknowledged.

Introduction

This case study requires an assessment of the risk factors associated with the use of forklifts. Forklifts are commonly used for extended periods within a wide variety of industries. Drivers typically report back and neck pain and discomfort. Ankle and knee injuries also commonly occur when alighting from the forklifts.

The following pictures illustrate typical forklifts.

![Forklifts](image)

Prompt: What injury risk factors are apparent here?

Discussion: Exposure to whole body vibration during vehicle use is frequently underestimated as a contributor to musculoskeletal injuries, and particularly back pain. Research has consistently linked fork lift driving with a high incidence of back pain caused by vibration exposure (e.g., Brendstrup & Biering-Sorensen, 1987; Boshuizen, Bongers, & Hulshof, 1992). The resonant frequency of the body ranges from 2 Hz for lower limbs, 4–8 Hz for trunk and shoulders, up to 50-200 Hz for the hand (Chaffin & Andersson, 1991). Most important is this context is the resonant frequency of the spine, and lumbar spine in particular (lower back) which is about 4 Hz (Panjabi et al., 1986). Vibrations close to the resonant frequency of the spine (such as those typically encountered in vehicles) are amplified, causing damage through a cumulative process of microfractures to the endplates of the vertebral bodies. Exposure to whole body vibration may be reduced by provision of
seating which reduces the amplitude of vibration transmitted to the driver.

For the driver illustrated here, the seat is too low relative to the pedals with the consequence that the thighs are horizontal, rather than inclined downwards. This causes the normal curvature of the lumbar spine to flatten, and fatigue occurs more rapidly as a consequence. Forklift seats should be height adjustable to accommodate employees of different dimensions, include a lumbar support to maintain the normal curvature of the spine, and be designed to reduce vibration exposure as far as possible.

The cut out foot hold provided in the forklift illustrated is difficult to use while exiting backwards from the cab, (and impossible to use if exiting forwards). Consequently, operators jump to the ground. The result is impact forces on the ankles, knees, and spine which can cause acute strains and sprains, or contribute to cumulative damage to these structures. Access to forklifts could be improved by providing more extensive handrails and larger, lower steps which can be used while exiting forwards.

To operate the forklifts, drivers need to see the tynes. Prompt: What is the injury risk apparent in the pictures below?

Discussion: The snapshots above illustrate the range and variety of awkward postures which are typically adopted during forklift operation. Note the neck extension, rotation, and lateral flexion involved at different times. The primary cause of these postures is the visual requirements of the tasks, combined with the restricted visibility of the forklift operator. Many forklifts do not allow the seated operator to view the tynes at critical times of loading and unloading. In addition to the risk of damage to person and property resulting from errors caused by this reduced visibility, the awkward postures adopted (especially the neck postures) will contribute to musculoskeletal discomfort and injury.
The necessity to adopt awkward neck postures may be reduced by larger windows, narrower window frames, and optimally placed windows (Eklund, Odenrick, Zettergren & Johansson, 1994). Video monitors and mirrors have also been found to be useful. If forklifts cannot be purchased which have sufficient visibility for all tasks required to be performed it may be possible to modify forklifts to provide appropriate vision for a specific task and dedicating the forklifts to that task only.

Forklifts are frequently driven in reverse as illustrated below. **Prompt:** What is the consequence?

![Forklifts reversing](image)

**Discussion:** Reversing requires extreme rotation of the trunk and neck, and these awkward postures may be maintained isometrically for relatively long periods of time if the distances to be travelled are great. The consequence in the short term is discomfort, particularly in the neck and shoulders. Rotation of the lumbar spine per se is a risk factor for back injury, and may also exacerbate the injurious effects of vibration.

The most effective way to prevent exposure to these risks is to change the work systems to remove the need to reversing to occur. If this is not possible then there are alternate strategies which could be explored, although none would be as effective in reducing risk exposure. For example, an alternate seating arrangement involving facing at right angles to the direction of travel has potential to reduce the neck turning required to reverse for long distances.

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New York: Wiley.


Virtual Reality Displays: What do we know about the health issues?

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Introduction

During the late 1980s and early 1990s Virtual Reality (VR) technology enjoyed a prolonged honeymoon with the international media who presented a glossy futuristic image of the technology. It was inevitable that the media would eventually tire of this image and look for new journalistic angles, such as the negative effects of VR. Some speculation then ensued about the negative social consequences of VR in the public domain ("Social autism" and "The end of civilisation as we know it..." - Stone, 1992, BBC Horizon), although these speculations now appear unfounded. The first direct assertion, in the international media, that there might be visual safety issues with VR technology, came from the reporting of findings from Mon-Williams, Wann and Rushton (1993). Since then a steady trickle of media features have strongly hinted at virtual problems that may arise (e.g. the \textit{Business Week}, July 10, 1995; \textit{New Scientist}, 27 Jan 1996), each being followed by accusations of "scare-mongering" from some sectors of the VR community. Our research findings have fuelled some of the negative reports, and our position has angered some VR protagonists. Also, like other research groups in this field, we are often approached by journalists in pursuit of a sensationalist story. Hence we think it is timely to examine what we know about the effects of virtual reality displays; what we don't know about virtual reality displays; and what research should be undertaken to resolve the unknown issues.

What kind of displays?

We must first define what we mean by a "virtual reality" display. It has become fashionable to label a wide range of systems as being \textit{VR}. The result of this trend is
that a heterogeneous group of systems are subject to generalised observations. It is therefore necessary to identify what features are common between displays and where systems diverge. For this we will use the following definitions:

**Monocular Display:** A simple, literal interpretation of this term is that the display is only seen by one eye. Such displays are used for information systems (e.g. *Private Eye*) and some head-up displays and *monocular* should be reserved for these types of system.

**Bi-ocular Display:** This is not a term in common usage, but is apt to described the situation where two eyes view a single screen image (e.g. a conventional computer monitor). In this case the eyes do NOT receive IDENTICAL images (unless the image is placed at infinity). A conventional computer screen is still seen from two different perspectives, but the disparities present in the two retinal images specify a single flat plane at the depth of the computer screen. Hence bi-ocular displays do contain *binocular information* (about the depth of the image), but there is no binocular information about depth increments *WITHIN* the image.

**Stereoscopic Display:** As outlined above, *bi-ocular* displays do contain *binocular* information about the global depth of the image, in a *stereoscopic* display, however, there is also information about depth *WITHIN* the image. This is produced by providing each eye with a disparate image of different parts of the display, such that if these parts are fused they will *"pop-out"* or *"pop-back"* in apparent depth. An important distinction to make, however, is that stereopsis is the static percept that results from fusion of two binocular images into one. Binocular information can be useful without stereopsis per se. The percept of motion in depth has been shown to be produced by the relative motion of the two disparate images across the retina. What is not generally understood is that a stereoscopic display can provide useful information (e.g. about impending collisions) even to someone who, on the basis of conventional clinical tests, lacks stereopsis.

In summary bi-ocular and stereoscopic displays are both subsets of binocular displays, whereas monocular displays are an exclusion set.

**Environmental Fixed Displays:**

**The Bi-ocular Desktop:** The simplest systems include conventional computer screens that allow for "movement" through a pictorially represented environment via a peripheral input device (e.g. a computer mouse). Such displays are essentially standard VDU screens and do not require exceptional consideration.

**The Stereoscopic Desktop:** More complex systems also use conventional screens, but attempt to produce an illusion of 3D depth by providing binocular depth information within the image. The 3D illusion may be produced by using polarising filters, or anaglyphs, and overlaying two disparate images or by using shutter spectacles to time-multiplex the generated array. The two views (half-images) that result simulate the inter-ocular differences that would occur between the retinal images of a fixated object due to the separation of the eyes within the forehead. Because the images are presented on a screen that is fixed within the environment, the extent to which the images project into/out-of the screen will vary depending up the position of the viewer. Hence it is not possible to
present an object at a specific depth from the viewer unless the system tracks where the viewer's head is relative to the screen (Fig. 1).

The Stereoscopic Cave: More ambitious projects have used very large screens to create a stereo-display or even multiple screens to create a stereoscopic cave into which the observer may wander (Cruz-Neira, Sandin & Defanti 1993). The principles are similar to those for the stereoscopic desktop: at any specific viewing position the two half-images specify a virtual, stereoscopic position in depth. An important point to emphasise with the Cave, however, is that the depth of the image is once again a function of the distance of the viewer (Fig. 1) and unless the viewer's head position is tracked the images will always recede in front of the observer. An advantage of the Cave is that it only requires geometric transformations in response to translation and not rotation of the head, so for the stationary observer the virtual images are relatively robust during rotational head movements.

**Figure 1.** Stereoscopic geometry of a Cave presentation and an HMD. The observer in the Cave at position V1 views two stereo-pairs (S1-R, S1-L) through polarising filters, or field sequential glasses to provide an illusion of an object at P1. If the observer moves to viewpoint V2 then the object will move to P2, unless head-position information is used to move the stereo-pairs to a new location (S2-R, S2-L). Similar transformations are required for the HMD, but in this case the system resolves which features should appear on a virtual image plane that is fixed relative to the head. If the geometric transformations are not implemented, then in the case of the HMD the world is stable and fixed, moving with the observer. In the case of the Cave, forward translation compresses virtual space. Note also that in the conventional HMD the observer always has to make the same accommodative effort, and the images may be collimated to infinity. In the Cave the images cannot easily be collimated and some stimuli (such as S1-R and S1-L viewed from V1) may also require unequal accommodation from the two eyes (see the later discussion).

Head mounted displays

The VR systems that have received most media attention due to their innovative design are, undoubtedly, head mounted displays (HMD). HMDs attempt to immerse
the user within the VR scene and allow more natural human/computer interaction within the graphic environment. It is common (although not inevitable) that a tracking device is mounted on the HMD so that as the user moves his/her head around, new visual perspectives can be displayed and the user can scan through 360[ring] or walk through the computer generated world (Fig. 1).

**Bi-ocular head-mounted displays:** These displays share the common characteristics of the bi-ocular desktop in that there is binocular information specifying the depth of the global image, but no binocular depth information within the image. There are three important differences between bi-ocular desktops and HMDs:

i) There is no true depth of the image so it may be placed wherever it is deemed practical. If an identical image is placed in front of each eye, the percept will be of a flat image at binocular infinity. In other cases, such as early versions of the Sony Visortron, two identical images were presented with a convergent bias such that they would be fused as a flat image at e.g. 3m from the observer.

ii) Conventional designs require that the screen images are viewed through magnifying optics, hence the focal depth of the image is open to manipulation.

iii) The high cost of both high resolution LCD and small scale CRT screens, means that mass produced HMDs are not able to match the image resolution available on desktop screens of a similar cost.

**Stereoscopic head-mounted displays:** Once again these displays share the common characteristics of the stereoscopic desktops, but incorporate the important differences outlined for bi-ocular HMDs:

i) Stereoscopic depth is completely specified by the system, hence unlike the stereoscopic desktop, images can be presented that are fixed in depth with respect to the observer's viewpoint and, unless computationally specified, this depth is not changed by head motion (e.g. the proverbial carrot that dangles before the donkey).

ii) The image is no longer at a single binocular depth, but there is a single focal depth dictated by the optical system.

iii) Resolution is likely to be lower than for a desktop system which may have consequences for the stereoscopic and focal stimuli presented.

**Bi-ocular and Stereoscopic head-up displays:** The final subset of HMDs we will consider are those in which the display allows a see-through capability to the real world (e.g. Virtual IO i-glasses). This arrangement facilitates a system where information can be superimposed onto a natural scene. The points outlined in (i) - (iii) above still hold but have some different consequences. The fixed viewer-centric reference (i) means that head-tracking is not required to present a stable image to the observer, whereas (ii) has the unusual consequence of overlaying a planar focal object (e.g. an ethereal cardboard cut-out) onto a natural scene that has a continuous focal range.

"**True 3D" Displays:** The final type of VR systems worthy of mention are volumetric 3-dimensional displays. These displays (using such technology as holographic imaging) are likely to circumvent some of the potential problems of
stereoscopic presentation we will later outline, but their development lags the current use of other systems and are unlikely to be available in the short-term. We will therefore confine our deliberations to current market place technology.

What we do know

In considering the response of the visual system to a given display, it is essential to shift the debate from the display hardware employed to the common perceptual characteristics of specific displays. Some researchers have responded to reports of VR display problems by declaring that they "use large screen stereo-displays rather than HMDs" or that "those finding were on old displays and we're using a new model". What needs to be recognised are the similarities between the stimuli presented by different display hardware: A stereoscopic desktop, stereoscopic cave and stereoscopic HMD present very similar stimuli to the user's binocular system, but may vary in their display resolution and field of view. Similarly, a well manufactured and well adjusted bi-ocular HMD should not present binocular demands beyond that of a conventional computer display, but may present a lower resolution image. It is also the case that the basic principles for generating a stereoscopic display from an image source has not changed since Wheatstone (1852). Hence most stereoscopic displays, whether they be desktop or head-mounted, new generation or old generation, share some common, fundamental features that are of consequence for the human visual system (Wann et al, 1995). To re-iterate, rather than focusing upon the specific hardware that is used to generate visual stimuli, a principled approach to evaluating the potential effects of VR displays should consider:

i) The visual characteristics that are common across display types;

ii) The additional implications of any specific display features.

What we know about human binocular vision.

In order to consider the effects of aspects (i) and (ii) above, it is necessary to consider the "firmware" of human binocular vision. It is not our intention to provide a comprehensive overview of binocular vision but to communicate the essential details.

Vergence: The role of the vergence system is to provide single vision from two retinal images. This is achieved by bringing the image of a specific feature close to the fovea of each retina, so that the two images can be fused into the percept of single object in depth (e.g. stereopsis). To achieve this the eyes must converge upon near objects and diverge when fixating distant objects.

Accommodation: For clear vision to be achieved, the eyes must focus on near objects and relax focus in the distance. This process is known as accommodation and is driven in a closed-loop fashion by image blur, such that the primary goal of the accommodation system is to minimise image blur.

Vergence-accommodation interactions To ensure that vision is both clear and single accommodation and vergence work together, with accommodation promoting a vergence response and vergence causing an accommodation response. If a change occurs in one system relative to the other, then adaptive demands are created. It is
known that the neural cross-links between accommodation and vergence (hereafter referred to as the ‘cross-links’) are open to adaptive change, although we don't fully understand the adaptive process, or its limits.

Potential sources of stress

We suggest that there are three areas of concern: (i) Poor engineering, (ii) presentation of stereoscopic images and (iii) incorrect user calibration. We should stress that these are potential areas of concern and may not be sufficient to cause problems.

(i) Poor Engineering: Early HMD displays demonstrated poor engineering with low resolution LCD screens, placed close to the eyes, providing poor contrast images at low illumination to the visual system. Other problems with these headsets include large temporal lags between head movement and display update, as well as generally poor ergonomic design. All of these factors have been documented as causing stress to the visual and balance system.

(ii) Presentation of stereoscopic images: Stereoscopic VR systems place demands on the visual system as they create a non-linear conflict in the cues for accommodation and vergence. The reason for the conflict is that current systems require the user to accommodate to only one depth plane whilst requiring vergence movements to a range of depths. This places adaptive demands on the cross-links but, as previously discussed, we do not fully understand how the visual system will respond to such a requirement (Fig 2).

![Figure 2. Stimuli to accommodation and vergence in natural conditions; when a constant vergence or accommodation error (bias) is introduced; and when viewing in a generic stereoscopic display. In natural conditions the stimuli to accommodation (empty symbols) and vergence (shaded symbols) are in accordance. If a lens or prism power is induced then the stimuli become discordant but the degree of discordance is constant regardless of fixation point. In a generic stereoscopic display the accommodation and vergence stimuli are disassociated and the degree of conflict depends on (and thus varies with) viewing distance.](image-url)
(iii) **Incorrect user calibration**: Just because a system does not display stereoscopic images it cannot be assumed to be problem free. It is possible for both accommodation and vergence errors to be introduced within the high powered optics of a bi-ocular HMD if incorrectly calibrated. Accommodation errors may be introduced by anomalies in lens power or, in adjustable focus systems, by incorrect adjustment. It is also possible for unequal accommodative demands to be required either due to the optics or because of stimuli presentation in systems such as the Cave (see previous discussion). Vergence errors are created when an HMD's lenses are not collimated to infinity (i.e. the screens are not at the focal distance of the lenses) and the user is not looking through the center of the lenses. It should be noted that any vergence error is likely to be minimal in comparison to the accommodative error that must be present for vergence error to occur. Generally, the visual system is able to cope with small demands placed on either the accommodation or vergence system. On the other hand, larger demands may be problematic and, furthermore, it is known that some individuals have only small degrees of tolerance. In addition, it has long been known that the demands placed upon the visual system alter according to vertical gaze angle (Hering 1868/1977). As vertical gaze angle is altered, the effort required by the binocular system to maintain clear single vision also changes (Heuer et al 1991). The display screens within an HMD are situated extremely close to the eyes and consequently very small changes in headset position will create large changes in gaze angle. We have recently studied this effect and found that even small vertical misalignment of an HMD can place stress on the visual system. This means that it is crucial for the headset to be in the correct vertical location for any individual user.

**What we know about existing VR systems**

We know that reports of nausea and/or visual symptoms following use of an HMD were common, if somewhat anecdotal, when these systems first became available. A study carried out by the British Ministry of Defence (Regan and Price 1993) confirmed a high incidence of symptoms, with 60% of participants using an HMD complaining of visual problems. The short-term effects on vision and binocular stability of wearing a "1st generation" VPL HMD to explore a VR environment were investigated by Mon-Williams, Wann and Rushton (1993). In this study 20 adult volunteers (aged 19-29 years), who had no ocular or general systemic disorders, wore a commercially available HMD for 10 minutes whilst cycling around a 3-dimensional VR road network. Visual function was assessed before and after immersion in the VR system using standard optometric tests. After wearing the HMD, 12 participants complained of symptoms such as eyestrain, headache and nausea. The important aspect of these findings is that evidence of physiological change was observed, and these changes correlated with the subjective reports of discomfort. We would stress that the physiological changes we observed were transient and had generally dissipated within 5 minutes, but note that we also limited the exposure time to 10 minutes. It would have been unwise for our participants to have attempted fine-control tasks during their 5minute recovery period. We observed equivalent results with other HMDs (Mon-Williams, Wann & Rushton 1996). We have also run informal trials (on ourselves) with longer exposures (>40 minutes) with a 2nd generation HMD and observed physiological changes that lasted for approximately 10 minutes.

Rushton, Mon-Williams and Wann (1994) repeated these original experiments
using a bi-ocular HMD produced by Virtuality Entertainment Ltd. Using similar conventional ophthalmic procedures with 50 participants, no problems were observed following the use of this display for immersion periods of up to 30 minutes duration. This study demonstrated that safe HMDs can be produced through careful design, precision engineering and a reduction of the binocular content of the display. We have examined the performance of this display in binocular mode and again observed that well designed and well adjusted displays can reduce the incidence of problems with binocular displays (Virtuality, 1996).

What viewing situations induce changes?

In order to explore the physiological changes in detail, our recent research has focussed on the consequences of placing pressure on the vergence-accommodation cross-links by deliberately putting the two systems in conflict with each other. First, we repeated our initial studies using a generic-stereoscopic display in which all sources of visual stress were removed apart from a variable conflict between accommodation and vergence. This used with high-resolution (1024*768) screens, with focal depth altered using contact lenses to eliminate adjustment errors. The results of this study clearly showed that the presence of conflict is sufficient by itself to produce physiological changes in the visual system (and related subjective discomfort). Second, we have directly measured accommodation and vergence in real-time while a subject was trying to follow an object moving back and forth in depth within a stereo-display system (a difficult task). The results of this study clearly demonstrated that the normal accommodation-vergence relationship was modified following prolonged use of this system. We therefore categorically state that we know conflicts between accommodation and vergence will lead to physiological change in the visual system.

Are these changes just minor artifacts?

As we have already noted the effects we have observed with HMDs are transient, but we have only examined short-term exposure. The problem in reaching definitive conclusions is that there are other publicly available investigations into the long-term visual consequences of immersion in VR systems. It is reasonable to assume that some companies have been involved in evaluating the visual consequences of their headsets but, unfortunately, this work is not been released to the scientific community. This is entirely reasonable on a commercial basis at a development stage, but it does highlight the importance of independent and public testing of commercially available systems.

What we don't know

We suggest that there are three questions that we are currently unable to answer on the basis of our existing knowledge and thus require research: (i) what causes the physiological changes observed after VR headset use; (ii) what are the consequences of these changes and (iii) what information is needed within virtual displays?

(i) What causes the physiological change? Although we have documented change occurring after use of a "1st generation" headset we are not sure why these changes occurred. This is because a number of undesirable factors existed, all of which had the potential to cause visual deficit. Furthermore, it is entirely possible that these
factors can interact with one another. Poor engineering is obviously not an inherent feature in VR displays but on the other hand, these systems do require many engineering compromises. Compromises must occur between screen resolution, field of view, size of display and cost. Unfortunately there is a lack of empirical knowledge on what factors are important within a display and it may be seen that such primary research would assist manufacturers to create appropriate systems. As display technology improves then so will the necessary compromises change. For example, low lags may exist between head movement and display uprate, but as displays become more complicated then so will the lags increase.

(ii) What are the consequences of adaptive change? Although we know that accommodation/vergence conflicts will lead to physiological change, we do not know whether these changes have any long term consequences. We also do not know what constitutes an acceptable demand for the visual system. The amount of conflict between accommodation and vergence may be important when determining the demands placed upon the visual system. Presentation of stereoscopic images may not, in itself, be problematic as long as the images are contained to one focal setting and the discrepancy between accommodation and vergence is not too large. Problems occur when a large depth interval is specified by the image disparity. A system may therefore appear to perform satisfactorily in one setting but cause difficulties when used with software that generates different images. Research needs to be directed at the degree of cross-link conflict that the visual system can tolerate.

(iii) What information is needed within virtual displays? We have previously proposed that the concept of VR should be used to describe systems which support salient perceptual criteria so that the user is able to perceive the computer generated image as structured in depth and then interact with this image. In order to design effective VR displays, a principled consideration of the factors that will affect the user's perception is required. We have discussed such factors elsewhere (Wann and Mon-Williams 1996), but it suffices to state that we do not know what perceptual information should be incorporated within a virtual display.

Conclusions

We know that some VR systems have the potential to cause problems to the visual system. Our previous research has demonstrated that at least one VR system DOES cause physiological change in the visual system, but also that at least one VR system DOES NOT promote such changes. Such a demonstration immediately highlights the differences that exist between VR systems and also between VR displays and other forms of display technology (e.g. VDU screens). It therefore seems reasonable to expect that VR displays systems, whether they be head-mounted or fixed-environment (CAVE) should conform to explicit safety and design criteria before being approved for the market place. At the moment, however, there is nothing to stop the sale of poorly engineered systems and we find this situation completely unsatisfactory. We do know, that potential problems can be minimised by careful design and visual problems are certainly not an inevitable consequence of VR immersion (Rushton et al 1994).

It also seems reasonable to expect guidelines or legislation to be issued regarding the standards to be expected from VR display technology. Legislation governs the requisite standards that VDU screens must attain, despite the lack of empirical
Evidence that these systems cause visual problems. There are no a priori reasons lead us to believe that VDU screens should cause ocular deficits, but there are strong grounds for suspecting that VR systems, by attempting to present three-dimensional images through two dimensional displays, will require changes in the visual system. We do not claim to know the implications of potential visual adaptation, and it is possible that any changes prove to be of little consequence. On the other hand, if adaptation is detrimental to some individuals then the consequences for VR technology are serious. Prudence may provide the best future for the technology and we would recommend that all manufacturers commission and publish formal appraisal of their systems. Whereas within the scientific community it is important to recognise the similarities and differences between systems. Two HMDs can superficially look very similar and yet place completely different demands upon the visual system, whereas an HMD and a CAVE may seem completely different approaches and yet may present very similar ocular-motor demands. It is inappropriate to generalising either about the effects of HMDs, or the advantages of fixed-environment displays, without considering specific design factors. The popular media will always wish to generalise and how scientists and manufacturers relay their information to the media with promoting speculation is possibly the most difficult task of all.

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Professional Development Resources

A selection of electronic resources.

The Floppy Stress Reliever

David Brown (davidbrown@onausstralialia.com.au)

The Floppy Stress Reliever is available for download from the Ergonomics Australia Online site. It is free for Ergonomics Society of Australia members, and "shareware" for all others, that is, use it for a month and then delete it or licence it.

In 1984 I was running a long series of workshops called "The Skills of RSI Management". After a few weeks I found that I was drawing the same chart on the board in every session, so to save time I put the chart on paper and called it "The Pocket Ergonomist". Thirteen years and more than a quarter of a million copies later, the Pocket Ergonomist (or in the IBM version, "Comfort and You") appears in 27 languages.

In 1987 I produced a software version, "The Floppy Ergonomist". It was a text-only package which covered the same ground as the paper version. Over the year I added information on eyes, stress, job design and correct use of equipment. I wrote an article for Ergonomics Australia (August 1988) about that exercise titled "The Design and Development of the Floppy Ergonomist".

The original Floppy Ergonomist used an extended character set to display "character graphics". Character graphics are fun, but not very realistic. In about 1991 Frank Darby from OSH in New Zealand asked if he could take the Floppy Ergonomist material and develop it with real graphics. His team produced a very interesting version with bitmap graphics and animated exercises in both DOS and Macintosh versions. It is still widely used in New Zealand, particularly in universities.

That result stimulated me to produce a Windows version using the Windows Help system. Although you can do a lot with Windows Help, even after several years of development I was never entirely satisfied with the result - it was never as well integrated as Frank's New Zealand version.

About six months ago I went back to the literature and found that many help authors including Microsoft had reached a similar stage of dissatisfaction with their Windows Help systems, and that as a result a new "minimalism" approach had developed. So I completely rewrote my design specification for Floppy Ergonomist, and called the newly simplified software "The Pocket Ergonomist" (because that name is well known).

Now to explain what this all has to do with "stress". In 1978 As a postgraduate psychology student I had reached the view that the common approach to stress was slightly but significantly wrong. I thought that the problem was not arousal but activation, and that the mechanism of "stress", at a physical level, could best be
described as "being ready to act for too long without a rest". I was promptly labelled "grandiose" by the academics who marked my paper, but I have worked with that idea of "stress" ever since, testing and developing it in industrial and clinical uses. I found that it worked, whereas the idea of stress as "fight or flight" did not work. These ideas were included in "The Floppy Ergonomist", but they never took the prominent place that perhaps they deserved - they were always just an addendum to the information about muscle tension and pain.

A year ago I decided to express my ideas about stress in a new Pocket Ergonomist style paper publication. This became "The Pocket Stress Reliever". The Floppy Stress Reliever is the same product put into a simple Windows Help file, with a lot of extra topics which are accessible through the Index.

To explain how it works, instead of saying "are you stressed", the Floppy Stress Reliever asks "Are you tired, or uptight?" The user clicks on the word "Tired" or the word "Uptight", and is taken to a second screen which lists the options for each of those topics. For instance "Tired" can result from:

1. New at the job
2. Job is unclear
3. Too many unfinished tasks
4. Interruptions
5. Telephone keeps ringing
6. Frustration
7. Deadlines

Clicking on each of those phrases (in the Floppy Stress Reliever, not in this text document!) displays a short block of text which explains what the problem is, and what to do about it.

So I have finally reached the point where I have expressed my ideas about stress in a way that satisfies me. Oh no, what do I do with my life now?

David Brown now commutes to Norfolk Island

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**Health and Safety Guidelines for Video Display Terminals in the Workplace (June 1991)**

Oregon Department of Insurance and Finance

Occupational Safety and Health Division

[http://www.cbs.state.or.us/external/osh/pdf/1863in97.pdf](http://www.cbs.state.or.us/external/osh/pdf/1863in97.pdf)
ZDNet on Working at Home

A web page devoted to working from home.

http://www5.zdnet.com/athome/content/hoffice/workathome.htm

American Society of Biomechanics

The American Society of Biomechanics has been providing online information for biomechanists via the internet for several years. During the past year, ASB conference abstracts have been formatted for web access (http://www.orst.edu/dept/HHP/ASB/abstracts/abstracts96.html) and recently the main ASB webpages have been recreated, expanded and relocated. The new address for accessing the ASB web pages is: http://www.orst.edu/dept/HHP/ASB/

Effect of Pronation/Supination on Carpal Tunnel Pressure


Medline access

The complete version of Medline is now available for online searching. Many entries include abstracts.


AnthroKids - Anthropometric Data of Children


Sandy Ressler

"This Web points to the results of two studies which collected anthropometric data of children. The report of the first study, performed in 1975, exists here as a scanned document with an HTML "front end" and as data in several formats. The second study, performed in 1977, exists here as only data, however users can access the data via a more graphically oriented interface. The textual descriptive portion of the report is being currently added."
These studies were the result of a Consumer Product Safety Commission (CPSC) effort in the mid-seventies. The creation of a publically accessible data base (this web site) is the result of a joint effort between the Information Technology Laboratory (ITL) at the National Institute of Standards and Technology (NIST) and the CPSC. Partial sponsorship is coming from the Systems Integration for Manufacturing Applications (SIMA) project at NIST. Prior to this effort the data did not exist other than on paper.

The primary goal to "computerize" the data has been accomplished. All of the tabular data was originally entered as spreadsheet data. A variety of conversion techniques were subsequently used to create HTML, plain ASCII (PRN), comma separated values (CSV) and other data tables, all of which are accessible (for free) via this web site.

In addition we are working with the Center for Human Modeling and Simulation at the University of Pennsylvania to incorporate the data into their Jack system. In addition we will be exporting VRML models of these figures to aid both in visualizing the data and to create a public resource.

This data, to our knowledge, is the only public domain data base of child anthropometric data. It should prove to be a valuable resource for product designers of all types, concerned with the safety of their products when used by children."

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**Conference Calender**

**1997**

- Nov 6-8, ASEA ERGONOMICS 97 - 5th SEAES Conference, Kuala Lumpur, Malaysia. Contact asean97@unimas.my; ph +6 082 672311; fx +6082 672312. [http://www.asean97.unimas.my](http://www.asean97.unimas.my)
- November 20, 28th NSW OH&S Conference and Convention. Advance Safe 97, Parramatta. Contact Conference Secretariat ph 02 9363 9858; fx 02 9362 0265

**November 25-27. ESA National Conference Gold Coast** ([see elsewhere in this issue](#)).

- November, 25-28, Third Australian Conference on **Technology for People with Disabilities**. University of Canberra. Contact ARATA 1997 Conference Committee, PO Box 60, Curtin, ACT, 2600; fx 06 281-3488, email acrodnat@ozemail.com.au; [http://www.iinet.net.au/~sharono/arata/arata3rdconf.html](http://www.iinet.net.au/~sharono/arata/arata3rdconf.html)

**1998**

- January 28-30, The Second conference of the Australian and New Zealand Society for **Biomechanics**. The University of Auckland, New Zealand. Contact: Ms. Patria Hume, Sport and Exercise Science, The University of Auckland, P.B. 92019 Auckland, NZ; ph +64 9 373 7599 ext 6859, fx +64 9 373 7043, email phume@tmknov1.auckland.ac.nz
- April 22-24 Global Ergonomics Conference, Cape Town, South Africa. Information from Bob Bridger UCT Medical School, Observatory 7925, South Africa; email: BRIDGER@anat.uct.ac.za
- May 11-15, Fifth International Congress - Australian Physiotherapy Association, Hobart, Tasmania; Contact: APA (Tas), PO Box 432, Moonah 7009, Australia
- July 5-8, Sixth International Conference on HUMAN ASPECTS OF ADVANCED MANUFACTURING: AGILITY & HYBRID AUTOMATION, Hong Kong. Contact: http://wwwspd.louisville.edu/~ergonomics/haamaha98.html
- August 14-18, The Third North American Congress on biomechanics, University of Waterloo, Ontario, Canada; Contact Stuart McGill email mcgill@health.waterloo.ca
- September 15-18th, IFPS'98 International Fall Protection Symposium, Wuppertal, Germany. Abstracts due August 1, 1997. Contact Roger Kahler, The InterSafe Group, PO Box 7338, East Brisbane, 4169. Ph. (07) 3895 8111; Fx. (07) 3895 8222.
- September 22-26th, 41st Annual Meeting of the U.S. Human Factors and Ergonomics Society, Albuquerque, New Mexico. Contact http://hfes.org; P.O. Box 1369, Santa Monica, CA 90406-1369 USA; 310/394-1811, fax 310/394-2410, email: hfes@compuserve.com.

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**Information to contributors**

The preferable form of submission is via email, either in the body of a message, or as an attachment. Files may also be mailed on floppy, (or Zip disc if very large). Virtually any format of files can be accommodated. Otherwise contributions should be printed in a large (14 pt preferred) non-serif font (such as Helvetica) and faxed to +61 07 33793545. Printed pages of similar specification may also be sent by post. Handwritten submissions will only be accepted in exceptional circumstances.

Intending contributors are invited to contact the editor to discuss potential submissions.

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All enquiries or feedback should be addressed to the editor, [Robin Burgess-Limerick PhD.](mailto:robin@hms.uq.edu.au)

Email: [robin@hms.uq.edu.au](mailto:robin@hms.uq.edu.au)

These pages are hosted by the [Department of Human Movement Studies, The University of Queensland, AUSTRALIA](mailto:)