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Dr Shirleynam M Gibbs
Email: shanng@optushome.com.au

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National Secretariat
The Human Factors and Ergonomics Society of Australia Inc.
Creeda Business Centre
281 Goyder Street
Narrabundah ACT 2604
Tel: 02 6295 5959  Fax: 02 6295 5946
Email: secretariat@ergonomics.org.au
Office Hours: Monday to Friday 9am -5 pm

HFESA Mission Statement
Promoting systems, space and designs for People
Editorial

What goes around comes around is an old saying that has some relevance to a recent upsurge in discussion online about mice and men and women too! Many health professionals in the ergonomics community must be experiencing a sense of back to the future with recent questions relating to office workstations. They could be justified in thinking that these issues were thoroughly investigated in the years following the eighties upsurge in overuse dysfunction. It could have been anticipated that twenty years of research and informed practice should have resolved the fundamental issues relating to posture, height, monitor position, chairs, mats, workplace stress et al that are again causing widespread concern. Certainly the advances in available equipment (such as mice) can create some additional / original concerns but the underlying ergonomics principles should be well established for resolving potential hazards as they arise. The lesson here, surely, is that nothing can be taken for granted and continual knowledge reinforcement is necessary.

The emphasis on occupational health and safety issues in ergonomics has been a notable priority in recent years. This has been driven by an insurance industry that is understandably concerned about the high financial cost [to them] of workplace accidents and injuries. This has created a long overdue need to concentrate on preventative strategies which have slowly gained more attention in relation to risk assessment and control in recent years. However, it still remains a difficult concept to foster in a litigious society in which workplace conditions are closely allied to management’s financial outlay in competitive markets. Worst case scenarios cause momentary shock, horror and concern; yet many bad or undesirable practices continue ... as for example, the failure to enforce the use of fall arrest harnesses as discussed in the Zupancic article in Ergonomics Australia last year. There are numerous other situations where human factors determine established habits and prejudices and these are the areas that are most difficult to influence and most in need of informed ergonomics intervention. The fallout from industrial injuries and death reaches far into the general community. Like a stone dropped into a pool, the ripples affect associated family, work and social groups, welfare support systems, community attitudes and eventually determine the condition of the pool itself.

It is gratifying to realize that this journal is beginning to attract a number of potential authors both within and beyond Australia. This also reflects the expanding horizons for ergonomics as the range of issues is steadily increasing in tandem with the development of this journal. The interview with Pierre Falzon, President of IEA, in the June 2004 edition, noted the need to become more aware and inclusive of the broad scope of ergonomics activity worldwide. This is echoed in David Caple’s IEA Column in this current edition. The featured article this quarter by a Melbourne member, Mike Regan, is: New technologies in cars: human factors and safety issues. Fortuitously, another initiative resulted in the journal’s first published short story being offered in a most timely fashion ... I thought you were driving! A story about vehicle automation ... contributed by an Englishman currently attending an Australian university. Subject to the referee process, there are two further articles in the pipeline that will address other aspects of the automotive industry.

By the time this edition is published there will be a new President of the HFESA as well as a new executive team from New South Wales. While wishing them a productive term in office, it is appropriate to thank the outgoing team for its contribution over the past two years. Margaret Head will continue to provide a sense of continuity via her role as Immediate Past-President on the next executive. She will also be able to focus on her recent development of a contaminated mail isolation system. Margaret is convinced that ergonomists have a significant role to play in a wide range of issues related to terrorism and we will hear more of this in the coming year. Meanwhile she has been appointed Chairperson of a newly established Standards Australia International (SAI) Working Party to investigate Mailroom Safety. It includes senior personnel from Defence, Police, Fire and National Security as well as from the health and science disciplines.

Margaret invited the editor of “EA” to be a member of this working party (based on the latter’s doctoral research and continuing activity in controlled environments) and the first meeting was held in Canberra in July. The discussion was focussed, even as it became clear that this particular problem represented the tip of an iceberg that would have endless ramifications for present and future security threats needing problem resolution and community education. Security of the built environment is set to become a vast field of knowledge development in relation to industry, health and community centres, schools and universities and other public places. Insecurity in these environments relates in part to physical and psychological threats associated with burglary and arson, to computer and telecommunications infrastructure, as well as building construction and building services. All this affects the personal protection of workers, or clients / patients and visitors to these establishments. Terrorism in various forms of civilian activity is a present reality in Australia ... not just a foreign militaristic aberration. A recent research project in which the editor took part, related to safety and security of patients, staff and visitors in mental health establishments. Her recent overseas visits supported her literature review and confirmed significant concern in the UK and USA about the design and operation of these facilities in relation to the human factors associated with such environments.

The final item to highlight in this editorial is the forthcoming CybErg Conference in 2005. This will be the fourth IEA Cyberspace Conference to be conducted in the year preceding the land-based triennial IEA Conference [next one 2006 in The Netherlands]. This series was begun in Western Australia under the direction of Leon Straker and Clare Pollock from Curtin University in 1996 and continued under their direction in 1999. The organization then moved to South Africa and the University of Witwatersrand under the chairmanship of Andrew Thatcher for CybErg 2002 and now again for 2005. Please take note of the entry under Noticeboard in this edition and think seriously about offering an intellectual contribution to this most important international link for ergonomics development. The Call for Papers has been issued and details are on the Noticeboard.

Shann Gibbs PhD
Editor

“Science is organized knowledge. Wisdom is organized life.”
Immanuel Kant
WHAT TO DO WITH CREDIT CARDS WHEN YOU DIE?

(A tale circulating on the Internet ... the bank's identity is deleted to avoid possible litigation)

While funny, this shows how frustrating a bureaucratic impasse can be. It is so easy to see this happening, customer service being what it is....

Motto: Be sure and cancel your credit cards before you die.........

My Aunt died last January. Her bank billed her for February and March for their monthly service charge on her credit card, and then added late fees and interest on the monthly charge ... the balance had been $0.00 ... it was now somewhere around $60.00.

I placed the following phone call to her bank:

Me: "I am calling to tell you that she died in January."
Bank: "The account was never closed and the late fees and charges still apply."

Me: "Maybe, you should turn it over to collections..."
Bank: "Since it is 2 months past due, it already has been."
Me: "So, what will they do when they find out she is dead?"
Bank: "Either report her account to the frauds division, or report her to the credit bureau...maybe both!"

Me: "Do you think God will be mad at her?"
Bank: "... excuse me?"

Me: "Did you just get what I was telling you ... the part about her being dead?"

Bank: "Sir, you'll have to speak to my supervisor!"

(Supervisor gets on the phone)

Me: "I'm calling to tell you, she died in January."
Bank: "The account was never closed and the late fees and charges still apply."

Me: "You mean you want to collect from her estate?"
Bank: "... (stammer)" ... "Are you her lawyer?"

Me: "No, I'm her great nephew." (Lawyer info given ...)
Bank: "Could you fax us a certificate of death?"
Me: "Sure." (Fax number is given)

(After they get the fax)
President’s Column

Ed: Given that the HFESA Conference is being held early this year, in late August, the Annual General Meeting which is held in association with that conference takes place while the September edition of the Journal is in the press. Margaret Head, current President, made her farewell remarks in the June Issue and Max Hely, President-elect, has indicated that he would prefer to wait until he is elected and has gathered his thoughts from the Conference in order to present a more focused introduction to his term of office when he writes his inaugural column.

The following short commentary is therefore inserted as a substitute item. Written by an American President in the early part of last century it is surely relevant for the many ergonomists working in the twenty-first century. The only concession would be to a more inclusive language as women have formal equality in this day and age!

“It is not the critic who counts, nor the man who points out how the strong man stumbles or where the doers of deeds could have done better. The credit belongs to the man who actually is in the arena; whose face is marred with dust and sweat; who strives valiantly; who errs and may fall again, because there is no effort without error or shortcoming, but who does actually strive to do the deeds; who does know the great enthusiasm, the great devotion; who spends himself in a worthy cause; who at best knows in the end the triumph of high achievement and who at the worst, if he fails, at least fails while daring greatly, so that his place shall never be with those cold or timid souls who know neither victory nor defeat.”

Theodore Roosevelt

IEA Column

REPORT FROM HFESA DELEGATE TO INTERNATIONAL ERGONOMICS ASSOCIATION COUNCIL MEETING – MADEIRA 2004

It is with pleasure that I provide a report on the IEA Council meeting held on Madeira Island, Portugal during July 2004.

As the HFESA delegate, I attended the 2 day meeting in Funchal – and also the 2 day Executive Committee meeting which preceded this – in my capacity as the Chairman of the International Development Committee.

Over 10 delegates attended the Council meeting from the 42 Federated Societies of the IEA. Considering that this was not an IEA Congress, it was considered an excellent attendance.

The format of the Council meeting involved:

• Annual Report by the Executive;
• Reports From Chairpersons of the Standing Committees;
• Voting items;
• Financial Report; and
• Additional Council activities.

It is relevant to note that the IEA President, Pierre Falzon, initiated two participatory workshops in the course of this Council meeting. This primarily resulted from his awareness of the need for closer consultation with Federated Societies following his visits to Australia, New Zealand, and Taiwan during March this year. He is seeking feedback from delegates as to how ergonomists within Federated Societies could more closely identify with their membership and their important role within the IEA. He reinforced the fact that IEA is merely a forum of volunteers from the Federated Societies that work collectively across a range of strategic goals, and without the participation and support of Federated Society members, the IEA loses its fundamental base.

The reports presented to the Council meeting highlighted a range of initiatives which are being undertaken on behalf of the IEA around the world. These include:

• A review of the IEA position on Masters’ education curriculum and competencies.
• The introduction of new technical committees reflecting emerging issues in ergonomics and human factors.
• A desire for closer co-operation with the World Health Organization and the International Labour Organization in assisting the development of ergonomics – particularly in countries undergoing economic development.
• Closer direct linkages between affiliated societies from developed countries with regions or specific societies in developing countries, for sharing of technical expertise and resources.
• The development of the EQUID program to identify products and services that reflect the ergonomics design process in their development phase. This project was possibly one of the more contentious initiatives by the IEA Executive but was supported by the majority of Council members for the next year of programs.

• The focus on the IEA website www.iea.cc as a central point not only about the IEA, but more generally about ergonomics as a science and profession. This site is currently the 7th most frequented site using the term “ergonomics”. It is hoped that through the provision of more information, the utilization of this site will increase further. It was interesting to note that one of the most frequently accessed elements of this site is the IEA definition of ergonomics.

• The opportunities for extending the linkages between ergonomics and other professions outside the health science area were extensively discussed. A specific standing committee has been formed to address these opportunities.

The minutes of the Council meeting will be circulated and submitted to a vote prior to the end of 2004.

The location of the IEA Council meeting in 2005 has yet to be ratified. However, the contenders are Bali, Indonesia, and San Diego, USA.

An email vote is currently being undertaken to provide all Societies with an opportunity to express their preference — since the vote during the Council meeting, among those in attendance — was particularly close.

As the HFESA Delegate, specifically invited to support the South East Asian Ergonomics Society (SEAES) meeting in Bali, during May 2005, I voted that the IEA conduct their next meeting at this location. I will inform the members once the final decision has been made.

As a gesture of goodwill, the IEA council collectively filled an envelope full of greeting cards for our HFESA delegate from 2003, Barbara McPhee. These subsequently have been posted to Barbara with best wishes from the International Ergonomics community.

If any HFESA member would like to discuss issues from the council meeting, I would be very pleased to elaborate. During the next edition of Ergonomics Australia, I will provide more details on the specific IEA programs and activities in which HFESA members may wish to engage and become more actively involved.

We are fortunate that we already have many members who are active participants in technical groups and have taken leadership roles at an international level. The contribution of the Australian family of ergonomists at the international level is highly regarded and our ongoing participation in the IEA programs and activities is strongly encouraged.

Best Wishes

David C Caple
NEW TECHNOLOGIES IN CARS: HUMAN FACTORS AND SAFETY ISSUES

Michael A. Regan, PhD, MESA
Senior Research Fellow, Monash University Accident Research Centre
Email: michael.regan@general.monash.edu.au

ABSTRACT

New technologies are rapidly finding their way into the car cockpit. Whilst these will make it possible to enhance the safety, enjoyment, and amenity of driving, the potential benefits to be derived from them could be outweighed by their potential to distract, overload and confuse the driver, and induce maladaptive behaviours that compromise safety. This paper discusses the current and future anticipated impact of these technologies on the driving task, and the human factors and safety implications of these developments.

INTRODUCTION

Driving a motor vehicle is, for many people, the most complex task they will perform during their lifetime. Not surprisingly, it is an activity that is prone to error. Last year in Australia, 1,634 people were killed and over 22,000 sustained serious crash-related injuries. Since the advent of motorization, over 171,000 people have died on Australia’s roads (ATSB, 2004). Worldwide, around 1.2 million people are killed and 39 million people are injured annually, costing OECD nations an estimated US$450 billion annually (Fildes, 2002). For this reason the driving task has been a major focus for research activity by transportation human factors professionals, who have contributed enormously to the significant reduction in lost lives, injuries and suffering that have occurred over the last two to three decades. Road trauma, remains, however, a serious public health problem and one which will continue to challenge the human factors profession for many years to come.

For several decades, the vehicle cockpit and road environment, and hence the driving task itself, have remained largely unchanged. The car cockpit is rapidly starting to evolve, however, and the role of the driver, like that of the aircraft pilot, will change – from being less of an active controller of the vehicle to being more of a systems monitor. This will result, over time, in an increased emphasis on higher-level cognitive activity, coupled with a decrease in the number and nature of control operations (Fuller and Santos, 2002). The human factors profession will have a vitally important role to play in shaping the future of the driving task, and hence the safety of future drivers and this is well recognised by vehicle manufacturers around the world. In this paper, some recent and emerging developments in vehicle technology are discussed. Consideration is given to how these will impact on the driving task. Finally, the human factors implications of these developments are discussed.

THE EVOLVING COCKPIT

Since its humble beginnings, the motor vehicle has undergone some significant transformations. Engines have become more efficient and reliable, vehicle bodies and interior cockpit structures have become more crashworthy, and mechanical linkages are increasingly being replaced by electronic connections. For the most part, these changes have been invisible to the driver. The cockpit, however, has remained largely unchanged. With the exception of automatic transmission and cruise control systems, which can be used to partially automate some primary vehicle functions, the driver still remains largely in direct control of the vehicle.

All of that, however, is starting to change. Three broad classes of vehicle technology are starting to enter the vehicle cockpit which, over time, will change the driving task. These are entertainment systems, communications systems and intelligent transport systems (ITS). Examples of each are described below.

Entertainment systems

The wireless radio has been augmented recently by a range of new systems. These include audio cassette players, Compact Disc (CD) players, video, television and Digital Versatile Disc (DVD) players. In addition to these, there is an emerging trend towards the provision of entertainment services to the driver though portable devices, such as the mobile phone or Personal Digital Assistant (PDA). In The United States, Europe and Japan, for example, information about the nearest restaurant, the latest movie, or other sources of entertainment can be accessed from these devices inside or outside the vehicle.

Communication Systems

Mobile telephones have been used in the vehicle cockpit now for over a decade, and before that Citizens Band (CB) radios and similar devices were used. More recently, however, a wider range of communications systems and services has entered the cockpit. These include text messaging, video messaging and conferencing, Internet, email, and facsimile facilities. The term “telematics” usually refers to the combination of vehicle computers and wireless telecommunications technologies that enable the provision of these wireless network capabilities. Some of the systems described above are currently being built into luxury vehicle cockpits overseas whilst others are being offered as services which can be accessed through portable devices brought into the vehicle, such as mobile phones and PDAs.

Intelligent Transport Systems

Intelligent Transport Systems – or ITS – represent the third main class of new technology entering the vehicle cockpit. These systems will have the greatest impact on the driving task.

ITS is an umbrella term for a collection of electronic, telecommunications and computing technologies that can be combined in various ways to increase driver safety, mobility and comfort (Regan, Oxley, Godfrey and Tingvall, 2001; Regan, 2004a). These systems are at various stages of development – some exist in production vehicles, others exist as advanced prototypes and others are currently being developed.
Some ITS have been developed primarily as safety systems. Of these, some are designed to prevent crashes from occurring, some are designed to minimize trauma to occupants in the event of a crash, and others are designed to further reduce trauma after the crash (see Regan, Oxley, Godley and Tingvell, 2001, for a review). Unlike "passive" safety systems (eg, airbags and seat-belt pretensioners) which operate autonomously, "active" safety systems, which include the ITS technologies described in this paper, keep the driver at least partially in the control loop. Hence, they are of greater interest from a human factors perspective.

**ITS for Preventing Crashes**

Various ITS technologies have been designed to prevent crashes. The main ones involving direct human interaction are described below.

**Intelligent Speed Adaptation**

Intelligent Speed Adaptation (ISA) systems automatically warn the driver if they are exceeding the posted speed limit anywhere on the road network. A variant of this system, fitted to 15 Ford passenger cars, is currently being evaluated in Melbourne, Australia, as part of what has become known internationally as the TAC SafeCar Project (Regan et al., 2003). In this study, each of 30 people will drive one of these vehicles, each of which is equipped with ISA, Following Distance Warning, Seatbelt Reminder and Reverse Collision Warning systems (see below), over a distance of approximately 17,000 km. The ISA system incorporates a digital map of the Victorian road network, including all speed zones, a Global Positioning System (GPS) and a central processing unit (CPU). The latter unit automatically computes vehicle speed and compares this with the posted speed in any given location. The system issues concurrent visual and auditory warnings if the speed limit is exceeded by 2 km/hr or more, followed by upward pressure on the accelerator pedal if the driver ignores these initial warnings. Similar systems, evaluated in Sweden, have been found to reduce mean speed by around 5 km/hr and it has been estimated that they have the potential to reduce speed-related crashes by up to 25 percent (Hjalmdahl, Almqvist and Vaheli, 2002).

**Following Distance Warning**

Following Distance Warning systems warn the driver if they are following a vehicle ahead too closely. A variant of this system is currently being trialed and evaluated in Melbourne, Australia, as part of the TAC SafeCar project (Regan et al., 2003). The system uses a microwave radar mounted at the front of the vehicle which detects the presence and movement of vehicles ahead. The device issues a series of graded visual warnings in the driver’s forward field of view if the following distance to a vehicle in front is between 2.0 and 1.2 seconds, and a continuous auditory tone at following distances less than 1.1 seconds. The TAC SafeCar study is the first in the world to evaluate the potential safety benefits of this technology in a long-term field trial. Short-term studies, conducted over a few hours of driving, suggest that following distance warning systems are effective in making drivers adopt longer following headways, even six months after they have used the system (Ben-Yaacov, Maltz and Shinar, 2002).

**Collision Warning Systems**

Collision Warning Systems warn the driver if they are about to collide with vehicles – in front of them, behind them when reversing, in their blind spots when merging or changing lanes, or when driving through or turning at intersections (Regan, Oxley, Godley and Tingvell, 2001). Reverse collision warning systems, used mainly as parking aids, have been available in Australia for close to a decade. Forward and blind spot collision warning systems exist in production vehicles in Japan, North America and Europe and intersection collision warning systems are being trialed in Japan. The latter warn the driver, via in-car displays, if they are on a collision course with another vehicle on the approach to an intersection.

**Lane Departure Warning**

These systems warn the driver if they are about to drive off the roadway. They exist on some production vehicles overseas, but are yet to be deployed in Australia.

**Driver Drowsiness Warning**

These warn the driver if they are assessed as starting to fall asleep whilst driving. Various systems exist, here and overseas, but few are presently capable of reliably warning the driver if the onset of drowsiness is detected.

**Alcohol Sniffer and Interlock Systems**

These detect, passively or via the use of on-board breathalyser units, when a driver has been consuming alcohol and warn the driver not to drive and/or prevent the vehicle from being started if the driver’s Blood Alcohol Concentration (BAC) is over some threshold limit. Sniffer systems are in commercial production in Sweden and Alcohol Interlocks, which have existed for several decades, are now imposed as a legal sanction for convicted drink drivers in Victoria and some other Australian jurisdictions.

**Vision Enhancement**

These systems allow the driver, usually through a Head-Up-Display (HUD) projected onto the windscreen, to see vehicles and other objects ahead in the dark or in conditions of poor visibility. They usually rely on infra-red technologies, used successfully by the military, to detect objects ahead and exist in some production vehicles in North America and Europe.

**Electronic Licence**

This system detects that a driver is unauthorized or unlicensed to drive and prevents the vehicle from being started. These exist as advanced prototypes in Europe.

**ITS for Minimizing Trauma During a Crash**

As noted previously, some Intelligent Transport Systems are designed to minimize the trauma to occupants if a crash occurs. Several such systems exist in which the driver remains in the control loop, albeit in a slightly modified manner.
Seat Belt Reminder and Interlock Systems
These remind drivers and their passengers to fasten their seatbelts and/or prevent the vehicle from being started if someone is unbelted. A variant of this system is currently being evaluated in Melbourne, Australia (Regan et al., 2003), as part of the TAC SafeCar project. Sensors under each seat and in each belt buckle detect if an occupant is unbelted, and a series of graded visual and auditory warnings is issued if any occupant remains unrestrained. Whilst comparable versions of this system now exist in some production vehicles in Europe, the Regan et al. study is the first in the world to study long-term driver behavioural adaptation to this class of technology.

Intelligent Speed Adaptation
These systems, described above, have potential to both prevent crashes and minimize trauma in the event of a crash: it is well known that lower vehicle speeds reduce the number of crashes and the severity of them.

ITS for Comfort
Some intelligent transport systems have been designed primarily as driver “comfort” systems, although they may have some secondary safety benefits.

Adaptive Cruise Control (ACC)
These systems are an extension of existing Cruise Control systems. Using frontal radar, these systems automatically increase the following distance to a car ahead (to some pre-defined time headway) – by reducing fuel flow and/or actively braking the vehicle - if the ACC is set to a cruise speed that is faster than the speed of a vehicle ahead. These systems have been on the market overseas for several years, and are now available in Australia on some imported luxury vehicles.

Route Navigation
These systems allow the driver to program in a destination (eg. 10 Smith Street Carlton), and then issue to the driver turn-by-turn instructions – by voice (eg, “turn left into Jones Street in 100 metres”) and/or via visual map-based instructions – on how to reach the destination. These systems are available in production vehicles here in Australia. In North America, Japan and Europe, this technology has been implemented on portable devices, such as mobile phones and PDAs, which can be used as navigation devices by drivers and pedestrians alike.

ITS for Minimizing Post-Crash Trauma
Finally, some ITS technologies are designed to minimize road trauma after a crash has occurred. Automatic Crash Notification (ACN) systems, for example, provide rapid emergency assistance to an injured driver. The system automatically dials for emergency assistance if the driver is unconscious. In minor collisions, the driver has the option of pressing a button for emergency assistance. Emergency services automatically know the whereabouts of the crash victim, as the ACN in the host vehicle contains a Global Positioning System (GPS). Data from ACN system-related crash sensors in the vehicle can also be transmitted automatically to emergency services to allow them to tailor their medical assistance to the type of crash which has occurred.

ITS — Automation and Configuration Issues
Some of the ITS devices described previously can be made to go a step further – to take physical control of the vehicle away from the driver. Intelligent Speed Adaptation systems, for example, exist that prevent the vehicle from exceeding the posted speed limit. These have been trialled in several European countries (see Regan, Young and Haworth, 2003, for a review). Forward collision avoidance systems have also been developed to automatically brake the vehicle if the system predicts that a forward collision is imminent. These have been trialled in the United States, Europe and Japan. Adaptive Cruise Control systems, however, are currently the only class of Intelligent Transport System in production vehicles that automatically take some primary control of the vehicle away from the driver.

Intelligent Transport Systems can be configured in different ways to solve specific safety problems. Some systems, like route navigation, can be self-contained within the vehicle or implemented on portable devices. Others, such as intersection collision warning systems, rely on road-side sensors – such as cameras and radars – to detect vehicles approaching the intersection and transmit this information, via in-car displays, to each of the drivers on a collision course. Alternatively, each car can be equipped with transmitters, GPS, digital road maps and receivers that enable each car to signal to the other, via on-board displays, that they are on a collision course. These are currently being trialled in parts of Japan. Finally, some Intelligent Transport Systems, such as Vehicle Message Signs (VMS), are embedded within the road infrastructure and can warn drivers about imminent hazards – such as fog, slippery roads, or a crash ahead – without direct physical communication with the vehicle.

In summary, many technologies exist, and are being developed, that are capable of making drivers safer, of entertaining them, and of enabling them to communicate with virtually anyone on Earth whilst seated in the vehicle cockpit. Some of these systems (eg. ISA) are also capable of increasing traffic efficiency and reducing environmental harm. Some of these are being implemented as dedicated devices on-board the vehicle, whilst others are being offered as services implemented via portable devices, such as mobile phones and PDAs.

IMPLICATIONS FOR THE DRIVING TASK
We are at the beginning of a major evolutionary change in the design of the motor vehicle cockpit. These technological developments will have a significant impact on the driving task and raise many human factors issues (Regan, 2004b). Consideration is given, first, to how these technological developments will impact on the driving task.

Driving involves six principal tasks (Brown, 1986; cited in Falkmer & Gregerson, 2003): finding your way; following the road; monitoring speed; avoiding collisions; following traffic rules; and controlling the vehicle. The Intelligent Transport Systems, described above, will impact on each of these tasks in various ways.
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**Finding Your Way**

Finding your way should be easier in future. Route Navigation systems will exist to provide drivers with turn-by-turn instructions on how to reach a selected destination. Even if drivers don’t have one of these systems, however, there will be the capability to display inside the vehicle information currently found on guide signs outside the vehicle, such as street name signs (e.g. Downshire Road) and direction signs (Melbourne 100). The technology already exists to “bring road signs into the vehicle”. Intelligent Speed Adaptation is one such example. Some prototype ISA systems developed in Europe, rather than issuing over-speed warnings, simply display to the driver continuously within the vehicle the posted speed limit.

There are several implications of being able to bring road signs into the vehicle. Drivers will be able to display them when they want them, and earlier in time than current road signs. They will be able to display them for as long as they want to, and to repeat them as often as they like. Drivers will be able to request that street names be presented auditorily and/or visually, and in doing so to receive the information presented to them as large or as loudly as they like - and they will be able to read and/or hear the guide information reliably under all weather conditions and at all times of day. If driving in another country, the information on guide signs could be presented inside the car in the driver’s own language, visually and/or auditorily. This flexibility to personalize the presentation of information has the potential to benefit particular road user groups, such as novice drivers, older drivers and overseas drivers.

**Following the Road**

Following the road should be easier. Lane departure warning systems (and drowsiness warning systems) will warn the driver if they are straying off the road and steering control systems, which exist as prototypes, will eventually be able to steer the vehicle automatically within the road lane.

**Speed Monitoring**

Monitoring speed should become easier for motorists. Like guide signs, it will be possible to display speed signs inside the vehicle. Alternatively, Intelligent Speed Adaptation systems will automatically monitor speed and warn the driver if the posted speed limit has been exceeded. More advanced (“dynamic”) systems, currently being developed, will monitor road and weather conditions and warn the driver at lower speed thresholds to adjust for prevailing conditions. Ultimately, Intelligent Speed Adaptation systems will automatically limit the vehicle to safe driving speeds, in theory totally unburdening the driver of the need to monitor speed. Such systems already exist as advanced prototypes and are being trialed in Europe.

**Avoiding Collisions**

Avoiding collisions should be easier. Information on warning signs, currently on the road side, will be able to be displayed inside the vehicle, much earlier. Intelligent Transport Systems will warn drivers if they are on a collision course with vehicles ahead (or objects overhead in the case of heavy vehicles), to their sides or in their blind spots. Eventually, these systems will be automatically capable of taking control of the vehicle to avoid a collision. In addition, Traffic Information Systems (TIS), which have already been deployed overseas, will convey to the driver information - inside the vehicle, or via portable devices such as mobile phones and PDAs - about road incidents, weather conditions, and temporary speed restrictions. These systems have potential to reduce driver uncertainty and prevent collisions by giving drivers early warning information in real-time.

**Following traffic Rules**

It should be easier, in future, to follow traffic rules. Information on regulatory signs currently on the road side - such as STOP and GIVE WAY signs - will be able to be displayed inside the vehicle. Intelligent Transport Systems will be able to automatically display messages to the driver to remind them to give way, to stop, to keep left, to slow down, and not to park in any given location. Ultimately, these systems will be linked to vehicle control systems so that vehicles are automatically stopped at road stop points, are slowed down on the approach to give way signs, cannot be driven into no parking areas or cannot be driven into a particular road lane.

**Controlling the Vehicle**

Ultimately, Intelligent Transport Systems may be capable of unburdening the driver of most driving tasks, including control of the vehicle - although there is much debate in the motoring world about whether this will ever be the case. At the present time, neither drivers (see below) nor vehicle manufacturers appear ready to hand vehicle control over entirely to the vehicle.

In summary, Intelligent Transport Systems are likely to have a dramatic impact on the driving task. Some emerging communication and entertainment tasks are already having an impact on the driving task, by distracting drivers from the primary driving task (see below). In the final section of this paper, the human factors and safety implications of these developments are considered.

### HUMAN FACTORS ISSUES

The human factors implications of these developments are many and varied. The more significant of these are discussed below.

**Driver Distraction**

Driver distraction has emerged as the first major negative by-product of the cockpit revolution, with the mobile telephone featuring prominently in discussions on this issue. Whilst distraction has been on the road safety agenda for some time in some other developed countries (e.g. North America, Europe and Japan), it has only recently become part of the agenda here (ATSB, 2004), largely as a result of research and lobbying by the author and his colleagues (Regan and Young, 2003; Young, Regan and Hammer, 2003). Concern about driver distraction has focused mainly on distractions deriving from within the vehicle cockpit, and stems mainly from the recent proliferation of communication and entertainment devices in the vehicle cockpit. However, poorly designed ITS technologies (such as some route navigation systems) which require the driver to take his/her attention away from the road frequently and for extended periods, can also induce
distraction. Distraction occurs when driving performance is degraded because some event, activity, object or person within or outside the vehicle induces the driver to shift his or her attention away from the driving task (Treat, 1980).

Driver distraction can take several forms. Visual distraction occurs when a driver takes his or her eyes off the road, for example to dial a telephone number. Cognitive distraction occurs when attention is taken away from the driving task. This occurs, for example, when conversing on a mobile phone. There is evidence that, whilst conversing on the phone, drivers suffer from “attentional blindness”; they physically detect and fixate on objects and events ahead, but fail to react to them because their attention is directed elsewhere (Strayer, Drews and Johnston, 2003). Physical distraction occurs when control operations secondary to the driving task interfere physically with driving control, for example when tuning a radio results in degraded steering control.

There is currently much research being undertaken by the human factors community to quantify the effects of distraction induced by different sources (eg Horberry, Anderson, Regan & Triggs, 2003) and, to a lesser extent, to quantify the degree to which drivers engage in distracting activities, given that distraction is a function of both the degree of driving degradation it induces and the frequency and duration of driver involvement in distracting tasks. Future research will need to include consideration of the potentially distracting effects of those emerging ITS services implemented on portable devices which are carried into the vehicle.

Young, Regan and Hammer (2003) have advocated various countermeasures for minimizing driver distraction. Those countermeasures most relevant from a human factors perspective relate to the need to design the HMI in a manner which minimizes distraction and to train drivers in the optimal manner in which to interact with existing and emerging technologies.

In relation to the HMI, huge research efforts are currently underway in North America, Europe Japan and, more recently, in Australia (by Holden in conjunction with the Monash University Accident Research Centre) to develop HMI designs that minimize distraction. There is much interest, for example, in the use of the auditory modality to reduce “eyes-off-the-road” time (for example, by using text-to-speech technology so drivers do not have to read visual information) and in the use of speech recognition technology to control systems vocally rather than manually. Auditory processing of information and the issuing of voice commands nevertheless demand attention and affect drivers’ scanning patterns (eg Goodman, Tijerina and Bents, 1999) and it remains to be seen whether “attentional blindness” can ever be fully eradicated in the vehicle cockpit. In parallel to these developments, human factors guidelines are being developed which contain performance-based goals that must be reached by the HMI so that on-board systems do not, amongst other things, distract the driver (eg. Alliance of Automobile Manufacturers, 2002; European Commission, 2001). International human factors standards are also being developed to standardize the definition and measurement of distraction (Rupp, 2004).

From a training perspective, it is important to train drivers to optimally interact with secondary tasks. Emerging technologies will make it easier for drivers to personalize and customize the manner in which traffic, entertainment and communication information is displayed and responded to. In most cars, there are already several ways of tuning a radio to a particular station, some of which are more distracting than others. Giving the driver access to information when they want it, for as long as they want it, as often as they want it, and in whatever sensory modality they want it, may be counterproductive if they choose to do so in a manner that increases distraction and information load. It is important that drivers are trained to employ those modes of interaction that are least distracting for them. Ideally, the HMI should be designed to limit modes of interaction to those that are minimally distracting (Young, Regan and Hammer, 2003).

Driver Workload

In the near future car drivers will be exposed, sometimes simultaneously, to traffic-related information from several sources (Regan, 2004b):

- from traditional traffic signs located outside the vehicle;
- from electronic variable message signs outside the vehicle;
- from in-vehicle displays (on portable devices or systems built into the vehicle) that duplicate inside the vehicle information on static or variable message signs outside the vehicle;
- from in-vehicle displays (on portable devices or systems built into the vehicle) that present real-time advisory and warning information derived from vehicle, road or cooperative intelligent transport systems;
- from the range of entertainment and communication systems noted previously; and
- from other vehicles and from the physical characteristics of the road environment itself.

Unless the HMI through which the information is presented is ergonomically designed, it will overload and confuse the driver. Where it is possible for multiple messages to impinge on the driver simultaneously, these must be prioritized so that only information that is necessary to support driving at a particular moment in time is presented and less critical or urgent information is suppressed. International ergonomics standards which define procedures for prioritising messages in this way have been developed (Rupp, 2004). The National Highway Traffic Safety Administration, in the United States, has recently funded a project known as SAVE-IT (Safety Vehicle using Adaptive Interface Technology) to develop a so-called “Workload Manager” (Foley, 2001). This is a vehicle sub-system that utilizes data from on-board sensors and ITS technologies to monitor the vehicle and the environment around it and make decisions about what information should be presented to drivers, and when and how it should be presented (Regan, 2004b). For such systems to be effective, traffic engineers, vehicle cockpit designers and the providers of services through portable devices will need to come together to resolve the issue of how to design a truly integrated Workload Manager that takes into account the different sources
of information impinging on the driver inside and outside the vehicle. The greatest problem in the immediate future will be the potential information overload, confusion and distraction induced by the unregulated proliferation of un-integrated devices and services brought permanently into the vehicle as aftermarket products, or transiently via portable devices such as mobile telephones.

Of course, there are many other human factors issues to consider in designing the HMI for ITS, entertainment and communication systems. There now exist many international performance-based standards, guidelines and checklists to support human factors practitioners in optimizing the design of the HMI for these systems (eg, Alliance of Automobile Manufacturers, 2002; European Commission, 2001; Stevens, Board, Allen & Quimby, 1999). Entire texts now exist on human factors issues relevant to the design, deployment and evaluation of ITS (eg, Barfield and Dingus, 1998).

Behavioural Adaptation

Drivers may adapt positively or negatively to new vehicle technologies. Positive adaptation occurs when a new technology brings about a positive change in driving behaviour, such as when an ISA system has the effect of making drivers reduce speed. Negative adaptation, when it occurs, may take two forms. Drivers tend to set themselves a target level of driving difficulty. If a road is made safer, people drive faster. If they are bored, drivers engage in distracting secondary activities. This has been referred to as “task difficulty” homeostasis (Fuller, 2002). If driving tasks in future vehicles become increasingly automated, and drivers have less to do, they are likely to engage more in secondary activities. If these activities are overly distracting, they will compromise safety. The other form of negative adaptation is system-specific. For example, it has been shown that people may go faster around a corner when they have an intelligent speed adaptation system, because they wait for the system to warn them that they are driving over the speed limit rather than driving to the prevailing conditions. This is known as “negative behavioural adaptation” (Summala, 2002). Similarly, Intelligent Speed Adaptation systems which limit vehicle speed to the posted speed limit have been shown to make people adopt shorter following distances. Human factors research is needed to identify the full range of behavioural adaptation effects, negative or positive, which derive from the use of different systems. Driver training will need to make drivers self-aware of the kinds of negative behavioural adaptation that can occur when they interact with these new systems.

Awareness of System Limitations

It is critical that drivers understand the technical limitations of the new technologies with which they interact. If their expectations of system performance are inaccurate, or too high, they may expect the system to alert them to critical situations or to prevent them from having a crash in situations in which the system is not capable of doing so. For example, they may crash into a car when reversing out of their driveway in the false belief that their reverse collision warning system is capable of detecting fast moving vehicles driving down their street. Driver training and other forms of procedural guidance will need to make drivers fully aware of the capabilities and limitations of new technologies, especially in cases of system malfunction or when moving to differently equipped vehicles.

Over-Reliance

As drivers adapt to intelligent transport systems, they may become over-reliant on them, believing that they can rely totally on them to warn them of danger and even to intervene to prevent a crash if necessary. It has been shown, for example, that drivers readily adapt to the use of collision warning and avoidance devices and rely on them completely after only a brief period of familiarization. In one study, when such a device was made to fail, a quarter of the drivers tested failed to take effective action and crashed (Stanton, Young, and McCaulder, 1997). Driver training will, therefore, need to make drivers aware and self-aware of the dangers of becoming too reliant on collision warning and avoidance technologies. Perhaps the more general issue to resolve is whether it is better, from a human factors perspective, to provide advisory warnings (such as following distance warnings) to alert the driver to potential danger early in the chain of events leading up to crash rather than a collision warning which follows the same chain of events almost to the point of the crash, or near-crash, and demands an immediate response. Reliance on the system is less of a critical issue for advisory systems (Dingus, Jahns, Horowitz & Knipling, 1998).

Risk Exposure Change

New technologies have the potential to change drivers’ travel patterns and, hence, affect their exposure to risks on the road network. It is known, for example, that route navigation systems can reduce navigation load and reduce unnecessary travel in unfamiliar locations — but they may at the same time encourage people to take more trips, to unfamiliar locations, increasing their exposure to risk. This may be particularly problematic for older drivers who, because of naturally occurring age-related decrements in driving skill (Fildes et al, 2000), may not be equipped to handle novel traffic conditions in these new locations. The general issue of exposure to change deriving from the use of new technologies has received little empirical attention from human factors researchers.
Effects of Automation

Increased automation of driving tasks currently performed by the driver can have several consequences.

Drivers’ learned danger avoidance skills and mechanisms, derived from control of current generation vehicles, will be weakened if the vehicle itself becomes increasingly capable of scanning for, perceiving and responding automatically to traffic hazards (Summala, 1997). Thus, training programs will, in future, need to be different from modern day ones. They will need to develop a different repertoire of skills, brought about by changes to the driving task. They will also need to equip those trained to drive in more advanced vehicles with the skills needed to enable them to take control of the vehicle should one or more of its automated systems fail, or should the driver need to drive a vehicle requiring manual control.

With increasing automation, there is increased scope for the driver to be lulled into a reduced state of attentiveness (Summala, 1997). This may have two consequences. Firstly, the driver may have difficulty in sustaining attention and remaining awake. Secondly, the driver may, as previously noted, spend more time engaging in non-driving related tasks. Little is known about these effects. Again, through education and training, drivers will need to be made aware of these issues.

Dingus et al (1998) point out that, unless the reliability of an automated system can be proven to be so great that manual overrides are not necessary, some allowance for manual control of the system, via a driver override, should be made. They point out, however, that many crash-avoidance circumstances that require automated control will occur so quickly that the driver may not have a chance to override the system. Further, the hurried action of a driver overriding the system might itself lead to a crash. Dingus et al suggest that, for this reason, overrides for automated systems will need to be carefully human engineered, if utilized at all.

Driver Acceptance

Intelligent transport systems for vehicles are products – but unlike most products, very little acceptability/market research has been done in Australia or elsewhere to understand what functions and services drivers require, how and when drivers will want to use them, and what barriers there might be to their widespread implementation. If user preferences are not well understood before systems are developed, the systems when developed may be unacceptable to consumers; in which case they will be difficult to market and their inherent safety potential may never be realized (Regan, Oxley, Godfrey and Tingvall, 2001). The very limited research that has been done in Australia to assess community acceptance of a wide range of over-the-horizon intelligent transport systems (eg. Regan, Mitsopoulos, Haworth & Young, 2002; Young, Regan & Mitsopoulos, 2004) reveals that Australians are fairly consistent in their views on emerging ITS: they are not yet ready to embrace ITS technologies that take vehicle control away from them (eg intelligent speed limiting technologies); they are unlikely to accept technologies that make them feel that “big brother” is watching over them; they are reluctant to embrace technologies with low reliability or a high false or nuisance alarm rate; and they will only purchase emerging systems if they are reasonably priced, have low maintenance costs, and are deemed to be useful, effective and user-friendly.

Individual Differences

Emerging ITS technologies will support or automate some driving tasks, such as navigation, which are currently difficult to perform by some members of the driving community (eg, older drivers). The greater flexibility afforded by these devices will also support the personalized presentation to drivers of traffic-related information if they have particular needs. Whilst much is known about differences in driving skills of different driver sub-groups (eg novice, experienced and older drivers), in current generation vehicles, very little is known about the effects of age, experience and other factors on drivers’ use of intelligent vehicle technologies.

These, then, are some of the key human factors issues that will need to be addressed as new technologies increasingly weave their way into the vehicle cockpit.

SAFETY ISSUES

Clearly, the various human factors issues discussed will influence both the uptake of, and safety outcomes deriving from, the use of the technologies reviewed in this paper.

There is converging evidence from simulator studies that engaging in a wide range of communication, entertainment and even everyday driving activities (eg drinking, smoking) whilst driving can significantly degrade driving performance (Young, Regan and Hammer, 2003; Horberry, Anderson, Regan & Triggs, 2003). It has been estimated that around 13 percent of police-reported crashes in the United States are attributable to driver distraction (Stutts, Reinfurt, Staplin and Rodgman, 2001; Wang, Knipling and Goodman, 1996). Whilst there is no comparable data yet available in Australia, it is reasonable to assume that distraction contributes similarly to those road accidents that result in trauma. Epidemiological studies have shown that the risk of being involved in a casualty crash whilst using a mobile phone (hand-held or hands-free) is about four times higher than when not using one (Redelmeier & Tibshirani, 1997). This increase in crash risk is equivalent to driving 10 km/hr over the speed limit and having a BAC over 80 mg/100ml (or 0.08). The only reason why hands-free mobile telephones are not currently banned from being used whilst driving in Australia is because it is presently impossible for Police to enforce such a ban. Less is known about increases in risk associated with the use of other emerging technologies. Both the positive and negative aspects of these systems, however, must be considered in developing road safety policies and programs. Entertainment and communication systems, whilst potentially distracting, are known to be effective to varying degrees in helping drivers maintain levels of arousal which may stall the onset of fatigue. Similarly, communication devices, such as mobile phones, can be used to render to drivers timely medical assistance in the event of a crash.
Intelligent transport systems have great potential to reduce road trauma. For example, it is estimated that, on their own, Intelligent Speed Adaptation systems of the kind currently being trialed in Melbourne (Regan et al., 2003), have the potential to reduce fatal crashes annually by around 18 percent, even at deployment levels far less than full market penetration (Carsten & Tate, 2001). Similarly, Regan et al. (2002) predict that this same system will prevent 330 casualty crashes per year in Victoria, saving the Victorian community around SM 155 per annum. The actual safety benefits of intelligent transport systems in vehicles, however, are unknown. This is because ITS technologies have not yet been deployed in traffic on a large enough scale over a long enough period for crash numbers to be a reliable indicator of a change in safety (Rumar et al., 1999). Even estimated benefits, such as those cited above, must be treated with some caution as they are often based on limited assumptions about the likely effectiveness of the technologies and their acceptability to drivers: the human factors and other issues which influence the effectiveness of these systems are complex and not yet fully understood. More long-term field evaluation studies, such as the TAC SafeCar study, are needed to yield performance data that can be used to fine-tune these safety estimates.

CONCLUSION

This paper has outlined a range of new technologies that are finding their way into the vehicle cockpit, the potential impact of these technologies on the driving task, and some key human factors and safety implications of these developments. Whilst these technologies will make it possible to greatly enhance the safety, enjoyment, and amenity of driving, the potential benefits to be derived from them might be outweighed by their potential to distract, overload and confuse the driver, and induce maladaptive behaviours that compromise safety. The human factors profession, as the interface between road traffic engineers, vehicle cockpit designers and the providers of entertainment, communication and ITS services implemented on portable technologies, has a critical role to play in the evolution of the motor vehicle. It is vital that the profession exercises this role early in, and throughout, the design, development and evaluation process to ensure that the evolution of the motor vehicle in Australia brings with it a reduction, rather than an increase, in road trauma.

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Short Story

I thought you were driving! A story about vehicle automation.

Mark S. Young
Department of Aviation
University of New South Wales

Future vehicle systems will have the capability of automatically taking command of lateral and longitudinal control. The following story is set in the not-too-distant future, and is intended to raise awareness of the psychological implications involved in implementing such systems.

Picture the scene: a busy motorway in evening rush hour, a set of road works causing a slow queue, and sure enough, a three-car rear-end collision. This was Jack Marshall’s first case study as a road crash investigator.

Jack’s early training and experience was in engineering, but he had subsequently signed up for a psychology degree. Combining his knowledge in these two disciplines led him to specialise in ergonomics, and his role in crash investigation was that of human factors expert. With the increased pervasiveness of technology in all aspects of life, the capabilities of humans were becoming increasingly important to the design process. Road vehicles were no exception, with the advent of automation, navigation displays, and even in-car internet, the humble horseless carriage really was becoming a mobile office. Jack had realised this, and firmly attached himself to the ergonomics boom that he felt was inevitable.

We join Jack as he arrives at the scene of the accident. His boss, Bob Williams, is briefing him on the state of play.

“Here it is then, the root cause, as they say,” Bob pointed at the nearly-new saloon at the back of the three stricken cars. “Mother and son, a 17-year old, are already on their way to hospital, mostly due to shock I expect. No serious injuries.”

“So is there anybody around we can speak to?” Jack asked.

Bob responded: “Well the woman in the middle car has been taken to hospital suffering from shock and possible whiplash, but her husband has been contacted and will meet her there ... she's clearly been caught in the middle of all this. We need to check the front driver’s story, and he’s still around. These guys came off rather better, and the gentleman is willing to talk to us.”

They made their way towards a four-wheel drive at the front of the crash queue, with minimal damage to its rear.

“Hi,” Jack raised his ID card to eye level as he approached the driver’s door. “I’m Jack Marshall, I’m here to see if I can find out what caused this accident.”

“To be honest, I didn’t see a great deal,” the driver replied. “All I knew was that the traffic had really slowed with the road works speed limits and all; I checked my mirrors a few times and saw the car behind me join the queue. Next thing I know she’s gone up my backside.”

“What sort of speed were you doing?”

“Only trundling along in second gear, must’ve been less than ten miles an hour. All stop-start, you know?”

“How about you?” Jack turned to the woman in the passenger seat. “Anything else you remember?”

“Nah, not really. I walked up when I saw it was a woman and her boy stepping out on to the verge, see if they were okay, you know?”

Something stuck in Jack’s mind as she said this, so he made a note of her comment. After the usual pleasantries, Jack wandered back to the saloon car, which was the focus of his investigation. He popped open the driver’s door, again with something troubling his subconscious as he did so. Jack crouched by the door and inspected the interior. Other than the spent airbags, it looked normal, the front crumple zone protecting the passenger compartment completely.

He scanned the instrument panel, surveying the interface design. It was evident that this car had a number of novel extras, which were becoming increasingly common on upmarket vehicles. Among them, Jack noticed a navigation display, an in-car internet system, cruise control, an entertainment system with direct voice input and output, and a brand new active steering system. He made a mental note to research these in depth later, remembering from his psychology education that any or all of these systems can adversely affect driver’s attention.

The next day, Jack drove to the hospital to interview the driver of the saloon car. On arrival, Jack was led to the ward, and found the son sitting on his mother’s bed.

“Hi, I’m Jack Marshall, I’m an accident investigator. I was wondering if I might talk to you about what happened yesterday?”

The boy turned to the woman in bed, and fixed her with a stare. “Sure, of course,” she said. “Do you want to go and get a Coke or something, Chris? I won’t be long.”

“Um, alright.” Jack thought that Chris didn’t look too sure at first, but a reassuring nod from his mum obviously set him at ease. When he’d left, Jack began the interview.

“How can you tell me in your own words what happened?”

“It was the damn car. We’ve only had it a couple of months.”

“You think there was some problem with the car?”

“It just accelerated by itself into the car in front! That cursed cruise thing, if you ask me. Could’ve killed us all. I’ll be looking to sue the manufacturer; I’ll tell you that for nothing.”

Jack noticed the woman getting visibly upset, so he decided to call the interview to a close. “I don’t need to ask you anything else just yet, but if I could get some contact details, Mrs...?”

“Dayton. Marie Dayton.”

Back at the office, Jack shared the new information with Bob over lunch.

“Sounds like she’s making excuses – the car sped up by itself?” Bob said incredulously.

“It’s far enough, though. I mean, people never like to admit they were wrong, it’s always easier to blame something else. She’s stressed, and this is her reaction.”
“Seems open and shut to me.”

“I’m not sure. She did mention not being particularly enamoured with the cruise control.”

“Ah – unintended acceleration.” Bob was referring to the phenomenon usually restricted to vehicles fitted with automatic transmission or cruise control, when the driver’s feet are off the pedals. The driver misplaces their foot onto the accelerator instead of the brake, and the car speeds off. In a fit of panic, and believing their foot to be on the brake pedal, the driver presses harder. This leads to a vicious circle, which only ends when something more substantial manages to stop the car.

“That was my first thought,” Jack replied, “but something isn’t ringing true for me. Do we have the reports from the physical examinations on the vehicles yet?”

“Preliminaries are on your desk.”

Jack fetched the documents, looking for evidence of damage to the accelerator pedal or the footwell, which would indicate undue pressure at the time of impact. Such damage would point to a conclusion of unintended acceleration.

“See, here there’s no signs of pedal damage,” Jack reported. “In fact the brake pedal is intact too. Now I think about it, the woman didn’t have any leg injuries either.”

“What are you getting at?” Bob was intrigued.

“Well, these things would suggest that neither of her feet were on the pedals when the crash happened. I need to look at the specs again.”

Jack went over to his desk, and rummaged through the papers he had piled there earlier. When he found the specifications for the saloon car, pieces of the puzzle began to slot into place.

“Adaptive Cruise Control!” Jack nearly shouted, bursting into Bob’s office with the specifications in his hand.

“What?”

“The car had adaptive cruise control fitted, not regular cruise. You know, the one that maintains your distance from cars in front, as well as your speed?”

“Ah, yes,” Bob remembered the relatively new device. “Slows you down when there’s a car in front, speeds you back up again when they go away.”

“Exactly. I didn’t realise it when I looked at the car, as the controls aren’t that different. I wonder if we’re now looking at uncommanded acceleration.”

“That’s a new one on me.”

“I just coined it, well, borrowed from aviation. Maybe the cruise dropped out — lost its target or something, and tried to accelerate back up to set speed.”

“That would certainly be consistent. And our friend Dayton might just have a case in court.”

“We need the technical analysis of the vehicle systems.”

“Won’t be available until tomorrow.”

After much poring over manufacturer’s literature and academic journals, Jack finally went home. Over dinner, Jack explained to his wife what he had learned about Adaptive Cruise Control.

“It completely assumes your speed control, so you don’t even have to brake when there’s slower traffic ahead. You just set your desired speed, and it tries to maintain it as best as it can.”

“So what happened in the crash? Did it decide it was bored?”

“Not exactly. These systems are not usually designed to detect really slow or stationary cars. It’s the manufacturer’s way of telling the driver, ‘You’re still in control, it’s your car, this won’t do everything for you, and — most importantly — it won’t stop you crashing.’”

“So are we now back to saying it’s the woman’s fault?”

“I’m not sure any more. I can’t really say until the techies tell us whether the ACC was working okay. It works by a computer chip, so it should be possible to access some sort of a memory.”

Jack was up bright and early the next morning, and found the report of the technical analysis sitting on his desk. As it turned out, there didn’t seem to be any evidence of malfunction with the ACC whatsoever.

“Back to the drawing board, then.” Jack went back to his desk to review his notes. He reopened his original files from the day of the crash — photographs, police reports, witness statements — as well as some of his course material from his psychology degree. He summarised these facts in his notepad:

1. Rear-ender initiated by Dayton’s car.
2. Police reports: no skid marks / pedal damage / leg damage = no effort to brake.
3. Dayton’s car equipped w/ ACC + other gizmos.
4. Specs: ACC not designed to stop for stationary / slow-moving traffic.
5. Dayton reports car sped up, techies say ACC fine.
6. Psych. course: some automation can affect performance, esp. if unskilled — hmm...

Jack remembered a couple of more points from the day of the accident, but didn’t write them down as his mind was racing. He got up to call Marie Dayton again, who had now been discharged from hospital. On his way to her house, Jack thought about exactly how he was going to handle this.

“Hello again, Mrs. Dayton. Look, I’m sorry to trouble you again. We’ve gathered pretty much all the information we can on the accident, but a couple of things aren’t sitting right. Could you go over your account again?”

“Well, there’s not much to say, like I told you. Everything slowed in front, and that damn new cruise system sped us into the back of them. I’ll be suing, you know.”
"Yes, I’ve heard. I’ve noticed your particular model of car is full of technical wizardry – do you like all of this stuff?"

“That’s my husband, he’s the gadget man. I’d rather just drive the car myself.”

“But you decided to use the ACC on this day.”

“More’s the pity, yes.”

“Were you using any of the other gadgets prior to the crash?”

“Erm, I think we probably had that automatic steering on as well,” Marie seemed like she was losing an edge of confidence in her reply. “Chris wanted to see how these things worked.”

“Steering system? Let’s see,” Jack leafed through his notes. “Oh yes, Active Steering, designed to keep you in your lane. So you didn’t have to do any driving then, your car was essentially on autopilot?”

“I guess so.”

“And you’re adamant that the Adaptive Cruise Control failed you and caused the crash?”

“Absolutely.” Marie was more defiant this time.

“Are you confident you knew how to use these systems?”

“What are you saying?”

“See, here’s the thing,” Jack said, finally getting to the point. “Our analyses show that there was nothing wrong with the ACC system.”

The boy and his mother exchanged glances.

“Were you aware that it’s not supposed to work in traffic queues, like the situation you were in?”

“Is it supposed to speed you up then?” Marie asked indignantly.

“No, but there’s no indication it did that either. Is it possible that you just felt that it sped you up?”

“Have you come round here to accuse me, Mr. Marshall?” Marie was getting hostile.

“I’m just trying to get to the bottom of this, really. It’s in everyone’s best interests. Look, I’m parched, why don’t we have a cup of tea and take five?”

Marie sighed heavily. “Right,” she said, and left the room to put the kettle on. Jack grasped the opportunity to speak to her son.

“So, Chris, you’re old enough to drive. You taking lessons?”

“Um, yeah.”

“I always think you can get a fresh perspective on things when you’re new at it. So how do you think the accident happened?”

“It wasn’t mum’s fault.”

“Oh, hey, I wouldn’t ask you to blame your mother. I’m just asking for your impression. What do you think of this ACC system?”

“Thought it was great, made driving the car really easy,” Chris started getting enthusiastic, but then caught himself. “Until it went wrong, that is. Didn’t know what it was supposed to be doing. I mean…”

Jack’s eyebrows raised. “Do you have lessons with your mum, Chris? Does she let you drive her car?”

“Um, sometimes, but not that day,” Chris said adamantly

“I never suggested that. Why, is there something you want to tell me?”

Chris looked panicked. “No! I didn’t – ”

“Do you take sugar?” Marie interrupted, her face dropping when she looked at her son’s face.

“No thanks. I think all three of us had better have a chat over this cuppa, Mrs. Dayton.”

“So, tell me how you figured all this out.” Jack’s wife was pouring the wine as they both sat down for dinner.

“Well, I guess something didn’t sit right from the start. I remember her car being stuffed with gadgets, and wondered at the time whether these might’ve contributed in some way.”

“Distracted her, you mean?”

“Exactly. There was a bunch of research on this a few years ago when we started seeing all these new toys appear in cars. People were worried that they might cause overload and affect driving. It’s not to say it was her fault, very often the design of these systems leaves a lot to be desired. You know, unnecessary complexity, poor interface – all takes the driver’s attention away from the road where it should be.”

“But you said that wasn’t the case here.”

“No, even though it seemed an obvious solution. And when I got the technical report back, I knew there wasn’t a problem with the ACC, so we were stuck.”

“How so? Wasn’t it just this distraction problem?”

“Again, could’ve been. But I wasn’t convinced – it’d be unusual on that kind of road, in the middle of her journey, to start messing with satellite navigation and all those other gizmos. No, if anything she would just have been bored. That’s when something started ringing in my head, and I decided to go back to basics.”

“After digging through my psychology notes, I remembered that automation can also cause underload when the driver has too little to do. I’d got caught up with trying to find out if there was something wrong with the ACC system, and forgot that their car also had an automatic steering system. Turns out both systems were on at the time of the crash, making it a perfect candidate for driver underload.”

“She was bored, you mean?”

“Not exactly. The theory is that our attention actually degrades when we don’t have enough to do. Think of attention like a balloon storing air – if there isn’t enough pressure, the balloon...
will shrink. But if you suddenly need a lot of air for whatever reason, you won’t have enough in your balloon. You need the pressure to maintain a higher capacity. In other words, our ability to cope with demands is reduced if our minds aren’t already occupied.”

“Makes sense.”

“And also explains why people can’t take over if automation fails, for instance.”

“Ah, I see where you’re going. But you said it didn’t fail.”

“No, but it didn’t do what they thought, having never used it in that kind of situation before. To them, it effectively failed, despite doing exactly what it was supposed to do.”

“I sense a ‘but’ coming.”

“However,” Jack continued, “the research also reckons that this doesn’t matter for experienced drivers. Although we get this underload thing, something like emergency braking is such a practised response it bypasses the problem. Our lady should’ve been fine, being an experienced driver.”

“So what was your clincher?”

“Two things. The first was the lack of skid marks. She should’ve at least tried to respond, even if she hadn’t been successful.”

“And the second?”

“Was a comment I almost missed by one of the other drivers, about the woman and her son both getting out onto the verge – I mean, out of the passenger side door. Didn’t pay it much thought at the time, but thinking about these issues of driver skill, and remembering the kid was of driving age, made me realise.”

“The son was driving the car on the motorway, when he shouldn’t have been.”

“Exactly. After having a chat with them, it all came out. She told her son to get out the passenger side, and she would say she was driving to cover up. Poor kid didn’t stand a chance — underloaded in an emergency situation, without the automatic reflexes to back him up.”

“What does all this mean for them then?”

“I don’t know, it’s out of my hands now. All I do know is that unless we find out more about this problem, my job is going to get a whole lot busier.”

Bibliography

For further information on the science behind the story, refer to the following published articles.


For a similar treatment, see:

Noticeboard

NEW MEMBERS

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CybErg 2005

"Meeting Diversity in Cyber/Online Ergonomics"

The important dates are as follows:

- Initial Call for papers: 1 September 2004
- Extended Abstracts for Full Papers due: 15 December 2004
- Abstracts for Short Papers due: 21 January 2005
- Notification of review: 25 February 2005
- Final Papers due: 29 April 2005
- Proceedings mailed: 29 August 2005
- Conference dates: 15 September - 15 October 2005

The CybErg conference series is based on the principle of internationalising ergonomics’ knowledge and increasing the quality of ergonomics discussion by making conference attendance easier, quicker and far cheaper than face-to-face conferences. It is quite easy to see how an international conference based on the World Wide Web can drastically reduce travel-related costs. Such a virtual conference also enables discussions and knowledge to be immediately accessible all around the world at the click of a mouse. The CybErg conferences are intended to take place in the year preceding IEA Congresses. This is to allow people to present preliminary findings or work in progress and to set up contacts that made be pursued at the face-to-face IEA Congresses. The CybErg conferences are also intended to allow people who cannot afford to travel to face-to-face conferences (such as students and participants from industrially developing countries) to contribute to the global dialogue on ergonomics.

We are most excited about being invited to convene and host CybErg 2005 from Africa again. Through three previous CybErg conferences, endorsed by the International Ergonomics Association (IEA), the conference already boasts an international standing in the scientific field, with particularly strong links to people and associations in Australia, North America, Europe, South America and South East Asia.

HOW DOES A VIRTUAL CONFERENCE WORK?

The idea behind a CybErg conference is similar to other face-to-face conferences. In fact, Cyberg conferences attempt to emulate as best as possible, the good qualities of face-to-face conferences. Extended abstracts are submitted for review by members of the International Scientific Advisory Committee and other internationally recognised reviewers. On the basis of reviewers’ reports (each abstract is reviewed by at least two independent reviewers), the highest quality abstracts are selected and successful authors are invited to extend their abstracts into full papers.

The full papers are then "presented" by the authors for the duration of the conference. For most of the papers, "presentation" means that the papers can be found in pdf and html format at the conference website for the duration of the conference. The CD-Rom proceedings are also mailed to all registered participants prior to the start of the conference. Registered participants are then able to read selected papers before the conference begins.
During the conference (which lasts for a four week period from 15 September to 15 October 2005) delegates are encouraged to read the papers and to make critical comments or ask critical questions in a bulletin-board format. Paper presenters are required to visit the conference site regularly to respond to comments on their own paper and to make critical comments of other papers. The discussions and answers on the bulletin-board are asynchronous (i.e. the discussants do not need to be online at the conference at the same time). In order to facilitate quality discussions, the conference lasts over a much longer time period than face-to-face conferences. It is hoped that a longer time period will allow for more meaningful, in-depth and quality discussion than is normally found at face-to-face conferences where presentations and discussions are usually quite rushed.

Some of the papers will be "presented" using virtual classroom technology. Papers presented in this format will be very similar to face-to-face conferences in that the presentations will use technology similar to PowerPoint presentations, and the presentations and discussions will use Voice-Over IP (VOIP) in a synchronous manner. Participants in the virtual classroom session will therefore have to be logged on and present in the session at the same time. For some of the participants this might mean getting up very early or staying very late. However, the synchronous session has the advantage of getting immediate answers to any questions or comments rather than waiting until an author responds.

Some of the opening keynote addresses will also be webcast. This means that if you are logged on to the conference website at the beginning of the conference you will be able to listen (and most probably watch) to the opening addresses. You will, however, only be able to ask questions using the bulletin-board, but will have the opportunity to get almost immediate answers on the bulletin board. Participants who are unable to make the opening addresses live will be able to listen to the saved webcasts at their own leisure and to participate in discussions based on the webcasts in the bulletin-board discussions.

In order to encourage quality papers and discussions, "Best Paper" and "Best Contributor" prizes will be awarded for the best scientific paper as well as the best overall contributor to the conference. A selection of the best papers at the conference will also get the opportunity to be published as journal articles.

**CONFERENCE THEMES**

The emphasis of the CybErg 2005 conference is on understanding and designing for diversity, hence the conference title "Meeting diversity in cyber/online ergonomics". Proposals for full papers, short papers and symposia are encouraged in the following areas. These are suggestions for themes and papers will not be limited to these themes.

**Physical Ergonomics**: including repetitive strain injuries, work-rest schedules, anthropometry, work-related musculoskeletal disorders, workplace layout, and manual materials handling

**Cognitive Ergonomics**: including human error, mental workload, naturalistic decision making, situation awareness, augmented cognition, and adaptive interfaces

**Human Computer Interaction**: including computer-mediated communication, augmented reality, ubiquitous computing, online communities, cross-cultural interfaces, and interface accessibility.

**Health & Safety**: including occupational health and hygiene, shift work, vibration, and epidemiological studies.

**Ergonomics Methods**: including ethnography, participatory design, organizational design, low-cost interventions, and usability testing.

**Community Ergonomic Development**: including reaching diverse user communities, community informatics, mobile communities, macro-ergonomics, and communication and education

**THE ORGANISING COMMITTEE**

The CybErg 2005 Organising Committee consists of the following local committee members responsible for organising this conference:

- Dr Andrew Thatcher (General Chair) - University of the Witwatersrand
- Jon James (Scientific Chair) - Rhodes University
- Andrew Todd (Technical Chair) - Rhodes University

**THE INTERNATIONAL SCIENTIFIC ADVISORY COMMITTEE**

The CybErg 2005 International Scientific Advisory Committee consists of the following prominent members of the international scientific community:

- Dr Ahmet Cakir (Germany), Director, Ergonomic Institute, Berlin
- Mr David Caple (Australia), David Caple & Associates
- Dr Alan Chan (Hong Kong), City University of Hong Kong, Department of Manufacturing Engineering and Engineering Management
- Prof Vincent Duffy (USA), Mississippi State University, Industrial Engineering Department
- Prof Jan Dui (Netherlands), Erasmus University, Rotterdam School of Management
- Dr Francisco Fialho (Brazil), Universidade Federal de Santa Catarina, Production Engineering Department
- Dr Shirleyann Gibbs (Australia), Editor, Ergonomics Australia
- Dr Doug Griffith (USA), General Dynamics Advanced Information Systems
- Dr Don Harris (UK), Cranfield University, Human Factors Group, College of Aeronautics
- Prof Kee Yong Lim (Singapore), Nanyang Technical University, School of Mechanical & Production Engineering
- Dr Dave O’Neill (UK), Silsoe Research Institute
- Prof Matthias Rauterberg (Netherlands), Technical University of Eindhoven, Faculty of Industrial Design
Conference Calendar

12–15 September 2004 — ECCE
12th European Conference on Cognitive Ergonomics Living and Working with Technology
University of York, UK
ECCE-12 will be held immediately following the British HCI Conference in nearby Leeds.
For an extended call and details of how to submit visit the ECCE-12 website: http://www.ecce12.org.uk/

20 – 24 September 2004
48th Annual Meeting of Human Factors & Ergonomics Society (USA) New Orleans, Louisiana USA
Featuring hands-on workshops geared to professionals at all levels as well as more than 100 technical sessions on a broad range of ergonomics-related topics; book, service and product exhibits; technical and research facility tours.
Further details:
http://hfes.org
HFES PO Box 1369 Santa Monica, CA 90406-1369 USA
Tel: +1 310/394-1811
Fax: +1 310/394-2410
E: lois@hfes.org

8–10 October 2004
6th ICOH International Conference on Occupational Health for Health Care Workers
KITAKYUSHU, JAPAN
Conference Secretariat
Dr. Kazuhiko Uchida, Dr.Yoshiyuki Hino, Dr.Katsuuya Furuki
University of Occupational and Environmental Health [UOEH],
Japan
Isigaoka 1-1, Yahatanishi-ku, KITAKYUSHU, 807-8555, JAPAN
Phone: +81-93-691-7171 Fax: +81-93-603-2155
E-mail: icohhw@mbox.med.ueoh-u.ac.jp
URL: http://www.hcw2004uoeh.jp/

18-20 October 2004, Verona, Italy
2nd International Symposium on Work Ability
Assessment and promotion of work ability, Health and well-being of ageing workers.
Please note that this announcement, as well as any other eventual further announcement/communication, will be available at website:
URL: www.cdldveto.it/ageing.htm

- Prof Gaur Ray (India), Indian Institute of Technology Bombay, Industrial Design Centre
- Prof Francisco Rebelo (Portugal), Technical University of Lisbon, Ergonomics Department
- Prof Pat Scott (South Africa), Rhodes University, Department of Human Kinetics & Ergonomics
- Prof Rahindra Sen (Malaysia), Multimedia University, Centre of Excellence for Ergonomics
- Prof Houshang Shahnavaz (Sweden), Lulea University of Technology, Centre for Ergonomics of Developing Countries
- Prof Marcelo Soares (Brazil), Universidade Federal de Pernambuco, Department of Design
Information for Contributors

Articles published in Ergonomics Australia are subject to peer review.

Editor
Dr Shirleyann M Gibbs
Gibbs + Associates Pty Ltd
25 Melaleuca Drive St Ives NSW 2075 Australia
Tel: +612 9983 9855 Fax: +612 9402 5295
E-mail: shanng@optushome.com.au
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December edition November 1

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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.

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

2005
21–24 March 2005, New Orleans, Louisian, USA
Real People. Real Results.
Hyatt Regency, New Orleans, LA
URL:http://appliedergonomics.lienet.org/conference
Tel: +1 800 494-0460, +1 770 449-0460
e-mail: cs@lienet.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
The International Society for Gerontotechnology
Nagoya, Japan
11th International Conference on Human-Computer Interaction
Caesar's Palace, Las Vegas, USA
Internet: www.hcil2005.engr.wisc.edu
Fourth International Cyberspace Conference on Ergonomics
Internet: www.cyberg.wits.ac.za

2006
30 March - 2 April 2005
International Conference - HEPS 2005 - Healthcare systems
Ergonomics and Patient Safety
Florence, Italy
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
10 – 14 July 2006 – IEA 16th Triennial Congress – Meeting
Diversity in Ergonomics
MECC Congress Centre, Maastricht, The Netherlands
Contact: Ernst AP Koningsveld
Congress Chairman
E: nvve@planet.nl

2007
Work with Computer Systems – Computer systems for human benefits
Stockholm, Sweden
Internet: www.wwcs2007.se
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