



CONNECTIONS

Volume 1 | Issue 3 | December 2021

Human factors and ergonomics for adaptive and resilient emergency departments

**Toward safer cycling:
A new cyclist incident
reporting system**

**Human factors
in aviation**

 **USC**
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A word from the Director

Welcome to the third issue of Connections, the Centre for Human Factors and Sociotechnical System's quarterly newsletter. The aim of Connections is to share our latest research with the Human Factors and Ergonomics (HFE) community and provide news on all things HFE, such as upcoming conferences, new publications, journal special issues, available PhD scholarships, and job vacancies.

Our third issue covers a diverse set of HFE application areas. We are extremely excited to tell you all about our recently released Cyclist Reporting of Incidents Tool (CRIT) App. The use of formal incident reporting and learning systems is a critical component of safety management activities; however, few such systems exist in road transport, particularly for vulnerable road users. CRIT provides Australian cyclists with a free App that enables them to report their crashes and near miss incidents as well as important associated information such as location, severity and perceived contributory factors. The data reported through CRIT will be analysed at the CHFSTS to identify incident trends and inform the development of safety interventions. Applying HFE theories, principles, and methods to support the delivery of safe and efficient healthcare is critical, particularly given current high levels of workload and technology insertion. One of the Centre's key collaborators, Dr Elizabeth Austin, tells us all about her recent work applying methods from the Cognitive Work Analysis (CWA) framework to help understand and optimise hospital emergency departments. This innovative work showcases how systems HFE methods can be used to help optimise healthcare environments, processes, and patient safety.

In our Practitioner Connections section, you will hear all about Centre adjunct member Associate Professor Steven Shorrock's work at EUROCONTROL which involves various activities to support the integration of HFE and safety theory and practice. In our Meet the Team section Kelly Murphy tells us all about her role as Program Manager in the Centre. Kelly plays an integral role, identifying research funding opportunities, writing and submitting research proposals, and post-award project management. Brandon King tells us all about his current PhD research which involves the use of systems HFE methods to identify and manage the risks associated with the use of brain-computer interfaces. To round out another packed newsletter, Dr Tony Carden is this issues' alumni member, providing an overview of his PhD and his current role as a Senior Ergonomist at WorkSafe Victoria.

I hope you enjoy the third issue of Connections and that it inspires you in your HFE work or studies! Finally, I would like to take this opportunity to wish you all a safe and Merry Christmas and a happy new year. I hope you all have a well-earned break and return refreshed and raring to go for 2022!



Enjoy!

Paul



Prof Paul Salmon

Director

 @DrPaulSalmon

Contents





The state of emergency: Human factors approaches to sustainable healthcare services

Dr Elizabeth Austin

In response to the COVID-19 pandemic, governments across the world made rapid changes to public health policies. Vaccines, mandatory face mask wearing, subsidised telehealth, contact tracing, physical distancing, and travel restrictions. All were introduced to reduce virus spread and avoid the potential collapse of our healthcare services.

Before the pandemic, our hospitals were increasingly operating at full capacity. Ambulances were ramping or forced to bypass hospitals because there were no beds available. Once patients made it into the Emergency Department (ED), they often faced a long wait to be seen, and an even longer wait to be treated. The longer patients spend in ED, the more likely they are to experience harm.

Counterintuitively, during each COVID-19 wave in Australia, we saw a drop in ED presentations, with fewer injuries and presentation hesitancy associated with fear of catching the COVID virus. While this might seem to reduce the strain on ED's, our hospitals were operating under additional burdens. They had to cope with multiple, daily changes to protocols for managing highly infectious patients and non-infectious patients in spaces not designed for this purpose. There was the added time and physical

“Hospitals had to cope with multiple, daily changes to protocols for managing highly infectious patients and non-infectious patients in spaces not designed for this purpose.” *Dr Elizabeth Austin*

burden of donning and doffing personal protective equipment (PPE) and the rapid and unanticipated shortages in staff due to quarantine protocols and emotional fatigue. Not to mention the rapid procurement of equipment, and ward redistribution to create overflow capacity for the anticipated influx of patients needing ventilation or intensive care. We have now reached the other side of Australia's third wave, with a return to pre-COVID presentation numbers, but staff are burned-out.

Over the years there have been many attempts to address ED crowding (Austin et al. 2020). For example, national performance targets, such as the four-hour rule, were introduced to reduce the time patients spent in ED. Senior doctors have been included in triage processes, handover has been standardised, processes and roles have been re-designed, and advances in technology leveraged.

Typically, these strategies address a single aspect of the ED system, such as triage or pathology testing. However, the ED is a complex, interactive, dynamic, system that comprises many different people, technologies, activities, and organisational structures. Addressing a single aspect of the ED system is like pulling a thread in a knitted jumper.

You might improve how that thread aligns within the knit, but it is unlikely to 'fix' the jumper. Especially if the jumper has holes (e.g., gaps in resources) or doesn't fit anymore (e.g., isn't meeting the community needs).

From outside the ED system, it appears that the challenges are absorbed and adaptations integrated into a coherent system performance. Yet patient experiences of harm, and staff burnout suggests that performance comes at a high cost. We need a smarter approach when designing how we provide care in ED. We need an approach that supports frontline staff to continue to develop innovations, but this time, in a way that considers the whole ED system. And we need an approach that supports the scale and spread of effective innovations to ED's across Australia. The discipline of Human Factors and Ergonomics (HFE) provides methods and tools that can help manage and respond to complex and difficult working conditions such as these. In particular, systems HFE offers a series of analytical methods that can be used to understand complex systems, how their parts interact, and how we can optimise their behaviour.

In collaboration with the Centre for Human Factors and Sociotechnical systems, we have been using a variety of systems HFE methods to develop innovations for ED systems. For example, the Cognitive Work Analysis (CWA) framework has allowed us to explore the nature of ED work and its many constraints. Using CWA, we recently developed a Work Domain Analysis (WDA) model of an ED (Austin et al. 2021a). The WDA shows how interconnected and complex the ED system is and identified aspects of the ED system that could be leveraged through innovations. Building on the WDA, we then used Control Task Analysis (i.e., Contextual Activities Template, CAT) and Social Organisational Cooperation Analysis (SOCA) (Austin et al. 2021b) to explore specifically how and where different tasks are currently undertaken and by whom (human or technologies) and how, where and by whom they could optimally be undertaken given design modifications. The findings demonstrated that there is currently conflict between the need to minimise waiting times and enhance patient safety, that there is a high reliance on technology despite poor usability and availability, and that thoroughness may be criticised rather than rewarded. Potential design interventions focused on strengthening the ED's adaptive capacity through increased accessibility and functionality of technologies such as computers, software, and phones, redistributing tasks to currently under-utilised ED spaces.

ED's are complex, interactive, dynamic, and

adaptive systems and the challenges they face are ongoing. We have demonstrated that the application of systems HFE methods can be applied within ED's to develop innovations in care for their own needs, or to support the adoption of an innovation developed in other ED's. Using these tools, we can foster adaptive capacity and amplify resilient behaviours in our ED's.

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Practitioner Connections

Dr Steven Shorrock

Senior Specialist Safety and Human Factors, *EUROCONTROL*

Adjunct Associate Professor, *Centre for Human Factors and Sociotechnical Systems*

What is your role?

I'm a senior specialist in safety and human factors at EUROCONTROL, an intergovernmental organisation for coordination and planning to optimise air traffic management network performance in Europe (41 Member and 2 Comprehensive Agreement States). In this role, I provide HF and safety support working with a variety of stakeholders, including air navigation service providers (ANSPs) and regulators.

What does a typical workday look like for you?

There really isn't one, so it depends. Much of the work is translational, communicating with people in operational, technical, management and other roles (e.g. legal and regulatory). I teach courses on systems thinking and human work for our Institute of Air Navigation (based in Luxembourg), and help to teach just culture principles to assist national prosecutors entrusted with the judicial review of aviation incidents and accidents. Other regular aspects of work include safety culture surveys, which we conduct for air navigation service providers, and I have overseen this program for several years. I am also editor-in-chief of Hindsight magazine, a publication on human and organisation factors in operations, primarily aimed at air traffic management staff. Other activities involve product development (e.g. discussion cards), helping to write policy and associated materials (e.g. the Just Culture Manifesto), helping to organise internal conferences (e.g. the EUROCONTROL/CANSO Global Resilience Summit), and ad hoc studies, which have recently focused on engineering. I also contribute to external groups such as ICAOs Human Performance Task Force (and their Human performance Manual for Regulators) and the Flight Safety Foundation (and their Learning from All Operations publication).

What HFE theories / methods do you use?

Most of my work is communicative and integrates theory and practice from Critical Systems Thinking and Practice, Safety-II, Resilience Engineering, Practice Theory and all aspects of human and organisational

performance. I integrate whatever is appropriate for the situation, often focused on the interfaces between groups. Specific methods for data collection tend to include interviews, focus groups and questionnaires, while methods for analysis and synthesis tend to come more from systems thinking, including system maps, influence diagrams, and AcciMaps.

How does HFE add value to your organisation?

There are a few of us involved with HFE, especially in a safety context. The work spans all safety activities, including contributions to safety policy, assessment, investigation, communication, culture, research, and support to regulation. Other aspects increasingly concern system resilience. Air traffic management is still highly human-centred, but the technological context is changing, requiring HFE input to potentially a huge range of situations and stakeholders.

What do you consider are the main barriers and facilitators for the use of HFE in practice?

The barriers depend on the context, but a critical one is a lack of suitably qualified and experienced practitioners and opportunities for them. In the UK National Health Service, for instance, there are very few for an organisation of over 1.4 million staff. There are many influences. For instance, there is misperception about the scope and nature of HFE. There is a lack of courses and graduates, though this is improving. And few practitioners are in roles of wide influence, leaving a perception of the profession as rather niche and technical. Key facilitators are communication and influence. There is little room for theory and methods without opportunities for practice. Having someone in a position of influence who understands the need and scope of HFE – whether or not they are an HFE specialist per se - can create huge potential and create many opportunities. The most effective advocates are outstanding at communication and relationship building and know that is the conduit for all progress.

“Air traffic management is still highly human-centred but the technological context is changing, requiring HFE input to potentially a huge range of situations and stakeholders.” *Dr Steven Shorrock*

Meet the CHFSTS Team

What is your role?

I joined the Centre as Program Manager in 2017. My role involves supporting the research team to develop and execute projects, including application and budget development, risk assessments, seeking internal approvals, and contract development/negotiations. I support the preparation and submission of milestones and other reports, assist with managing finances and oversee other post-award administrative requirements. In my role, I work closely with the CHFSTS research team, our students, adjuncts, collaborators, and funders, as well as other internal and external stakeholders.

How did you arrive into the world of HFE?

I worked closely with the CHFSTS team in my previous role in the Office of Research on many funding applications. I always found them dedicated, hardworking and passionate. When the position was advertised, it seemed like it was meant to be, so I applied and was very fortunate to get the job.

What do you enjoy most about your job / research?

The people! We have a great team, with such diverse backgrounds. I have learned so much from everyone in the Centre. There are lots of big personalities, which makes things interesting but we always have lots of fun.

What's your favorite quote?

"The pessimist sees difficulty in every opportunity. The optimist sees opportunity in every difficulty" ~ Winston Churchill



Kelly Stewart

Program Manager

 @Kel83Murphy

What is your PhD research?

My research will apply HFE methods to identify and mitigate the risks associated with the use of brain-computer interfaces (BCI). This will inform the development of BCIs and the preparation of societal systems to ensure that the benefits of BCIs are realised while reducing the negative impacts to users, developers, and society.

How did you arrive into the world of HFE?

While studying psychology, I heard about Elon Musk's Neuralink and I was stunned at the rate of progress on BCI development. This led me to question the impact of BCI use on the human brain and society through a lens of evolutionary and social psychology. I found that members of the CHFSTS team shared an interest in the impact of future technologies and Human Factors methods are uniquely suited to exploring these issues.

What do you enjoy most about your job/ research?

I love the process of finding an interesting, unanswered question and then employing empirical processes to arrive at a defensible answer and contribute to science.

What book or paper most inspired you on your HFE journey?

The Nights Dawn Trilogy by Peter Hamilton opened my eyes to the potential utility of BCIs and their impact on society, such as for communication, control of machines, enhancement of senses, and affective modulation.

What's your favourite quote?

"Today's science fiction is tomorrow's science fact" ~ Isaac Asimov



Brandon King

PhD Student

 @Brandon_J_King



CYCLIST REPORTING OF INCIDENTS TOOL

Toward safer cycling: A new cyclist incident reporting system

Cycling has numerous health, environmental, and economic benefits; however, the perceived and actual risks of cycling act as a strong barrier to prevent people from using bicycles as a form of transport. The statistics around cycling safety make for sobering reading. Globally, cycling fatalities make up around 6% of the total number of road deaths (WHO, 2015) and research has found that cyclists are 12 times more at risk of death than car drivers (Pucher & Dijkstra, 2003). In Australia specifically, cyclists make up 1 in 40 of all road crash deaths (Garrard et al., 2010).

Despite significant progress in enhancing cyclist safety, vehicle-cyclist collisions remain poorly understood (English & Salmon, 2017; Goode et al., 2015; Salmon et al., 2021). Existing crash analysis systems are limited, focusing only on a small set of causes, and there are few mechanisms available for road users to report sufficient details about collisions and near misses. In particular, cyclists have limited opportunity to report their crashes and near misses. As a result, interventions designed to prevent cyclist collisions have not had the desired impact, partly because they are not based on a full understanding of the contributory factors involved.

A recognised approach for helping to understand and prevent safety compromising incidents is the use of an incident reporting and learning system (Goode et al., 2018). This involves providing a mechanism to report incidents and their contributory factors and then using the resulting data to inform safety management activities. Whilst the use of formal incident reporting and learning systems is an accepted component of safety management in most safety critical domains, they are yet to be adopted in the area of cyclist safety.

Cyclist Reporting of Incidents Tool (CRIT)

Up until now, a valid and easily accessible cyclist incident reporting and learning system has not existed in Australia. As part of a program of research funded by the Road Safety Innovation Fund, we have developed the Cyclist Reporting of Incidents Tool (CRIT). The CRIT App provides cyclists with a free to use, simple, and quick way of reporting the crashes and near miss incidents that they experience whilst cycling, including important information regarding the incidents themselves (e.g. time and location, incident description) and the contributory factors involved. CRIT users also provide information on their weekly cycling hours, which enables the calculation of crash and near miss incident rates. The incidents reported through the CRIT App form the National Incident Dataset (NID).

With anticipated users from all over Australia, the information submitted to CRIT will be used by the research team to identify trends in incidents and incident causation, enhancing our understanding of cyclist crash and near miss causation and informing the development of strategies designed to enhance cyclist safety.

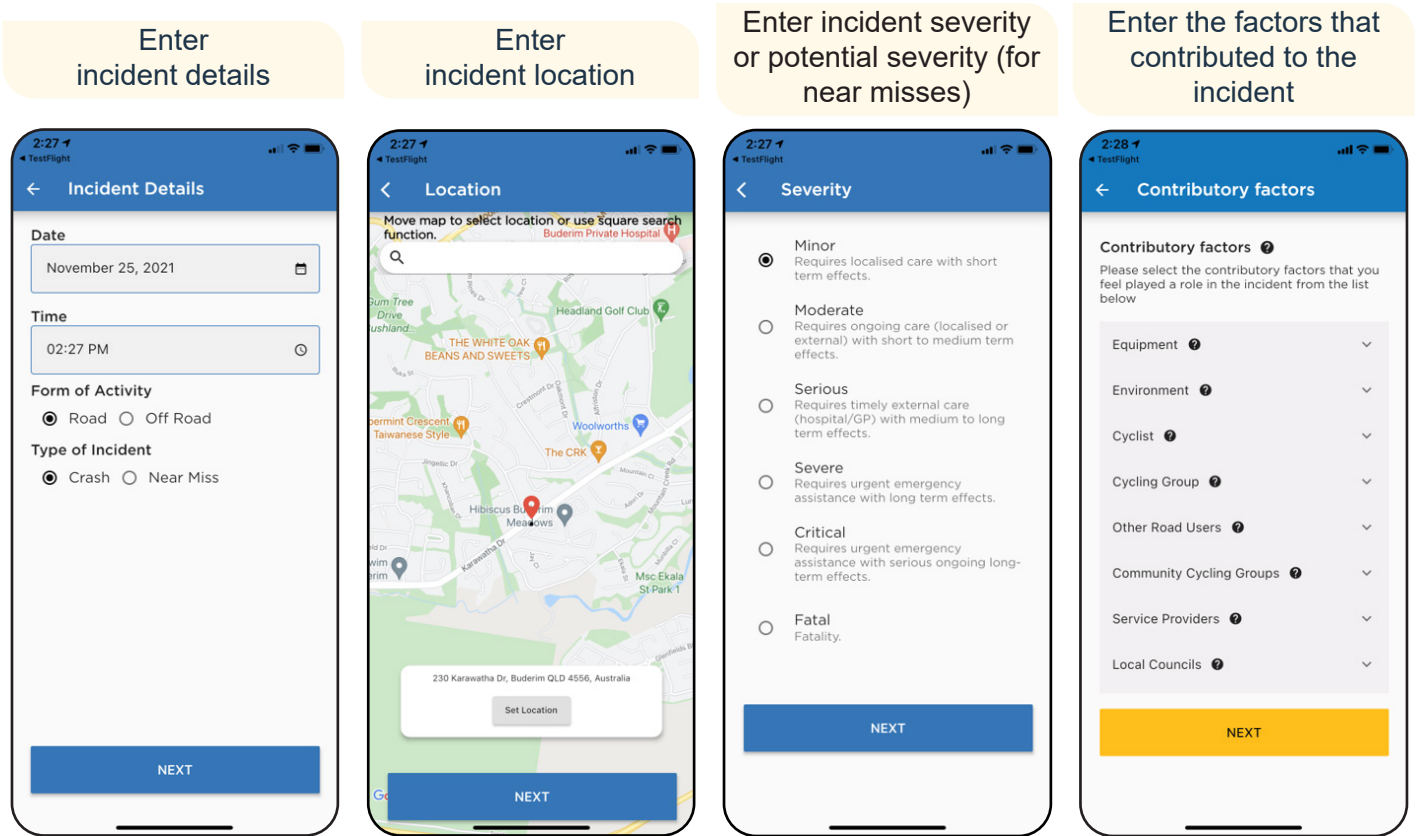
For more information

Visit the project's website: www.usc.edu.au/CRIT



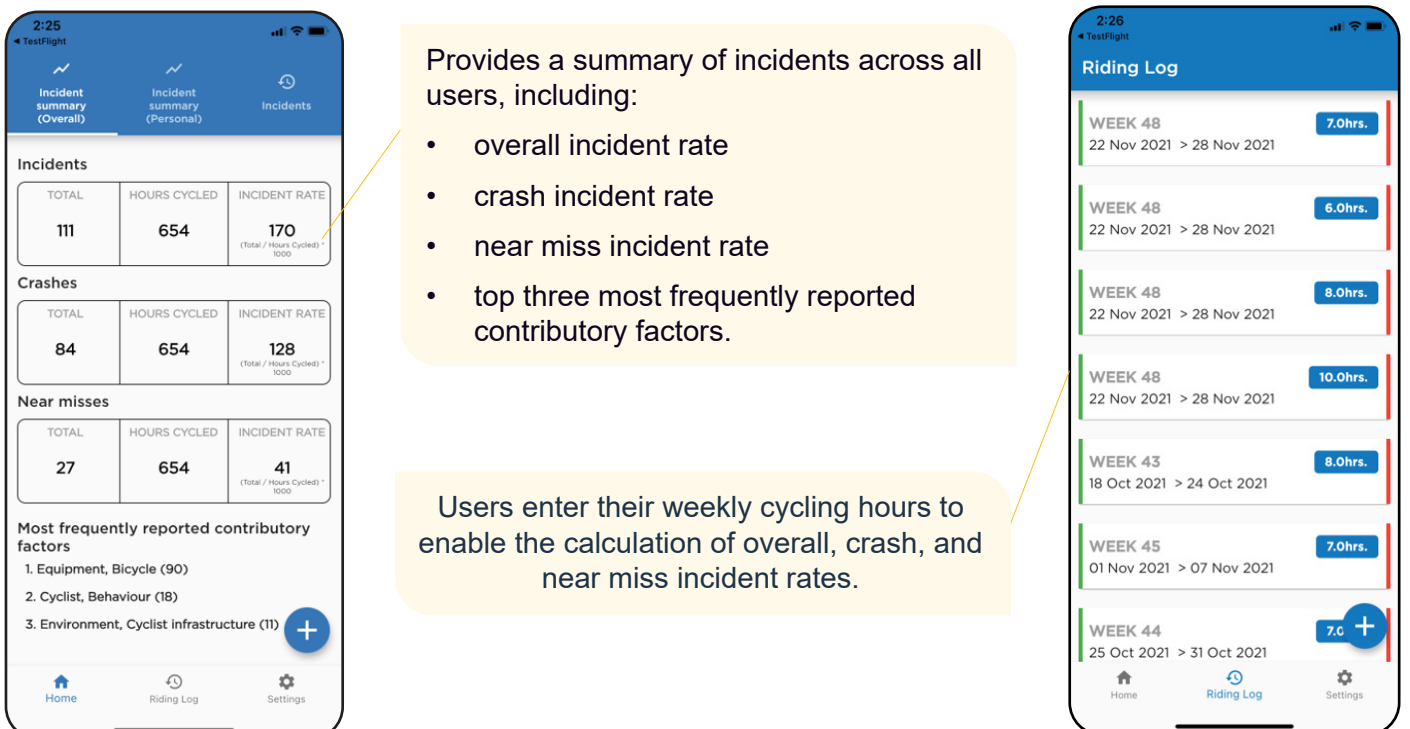
CRIT data collection

The CRIT App collects data that will enable a detailed understanding of cycling crashes and near misses, including incident type, location, and severity.



CRIT key features

The CRIT App provides a summary of the national data for crashes and near misses, as well as your own personal incident data. The CRIT App also calculates an incident rate which will show the occurrence of incident per 1000 hours cycled.



CHFSTS Alumni

When did you graduate and what was the topic of your PhD?

I was awarded my PhD in December 2019. My doctoral research was based on using human factors methods to improve the design of safety standards for led adventure activities. Most of these design improvements were implemented by the owners of the standards. This has led to significant improvements in the usability of those standards.

What motivated you to start a PhD with the CHFSTS?

I was inspired by seeing how Human Factors (HF) methods were being applied in the outdoor adventure sector in which I'd worked for many years. I saw the potential for wider application that could support continuing improvements to safety and system performance in that sector.

What aspect(s) of your PhD did you most enjoy?

Learning not only about the main methods I used in my doctoral research but also a wide range of other methods and theories has been, and continues to be incredibly interesting, stimulating and useful. Learning itself has become a fun and satisfying habit. Connecting with communities of scholars both in the HF discipline and beyond continues to expand my thinking and provide opportunities to consider new ideas and opportunities.

Where are you working and what is the focus of your work?

I now work at WorkSafe Victoria as a Senior Ergonomist. Most of my work centres on the application of systems thinking and HF methods to health and safety regulation. This includes projects focused on prevention of occupational disease, workplace violence and fatalities. It also includes running learning sessions for colleagues on systems thinking. It's very satisfying to be applying what I learned in my PhD to work that has a real impact and benefit for the wellbeing of others.

How has the information and knowledge gained during your PhD influenced your practice?

The theory, methods, and habits I learned during my PhD underpin most of my work. They allow me to bring novel perspectives and strategies to bear on problems that are valued by other stakeholders. The central aims of HF and ergonomics to improve human wellbeing and system performance align very nicely with the aims of occupational health and safety. I therefore encounter plenty of opportunities to both apply what I learned during my PhD and to continue to build on it.

What advice would you give people who are thinking about starting a PhD?

I'd encourage anyone who is thinking of starting a PhD to go for it! Things I think that will contribute



Dr Tony Carden

Senior Ergonomist
WorkSafe Victoria

 @DrTonyCarden

to your success include a deep passion for the problem you want to address, lots of curiosity about learning new things, and a willingness to engage and embrace the inputs and perspectives of your supervisory team and fellow scholars. The PhD journey will inevitably include significant highs and lows. It's a marathon not a sprint. When first thinking about starting my PhD, I thought the main requirement for success was being clever. My experience taught me that the key attribute needed is tenacity. It sounds cliched, but it's true for me that the personal growth and the enhanced ability to add value in the world that I gained from my PhD made both the journey and its completion just about the best thing I've ever done.



Interested in applying HFE in:

- Transport & Infrastructure
- Defence, Security, & Resilience
- Sport & Outdoor Recreation
- Organisation Safety, or
- Land Use Planning & Urban Design

Enroll in a Masters or PhD with us!

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HFE Conferences

| | | | |
|------------------------------|---|------------------------------|---|
| 20 to 23 March 2022 | International Symposium on Human Factors and Ergonomics in Health Care <i>New Orleans, USA</i> | 26 June to 1 July 2022 | International Conference on Human-Computer Interaction 2022 <i>Online</i> |
| 20 to 22 April 2022 | Human Factors and Ergonomics Society (Europe Chapter) Annual Meeting 2022 <i>Turin, Italy</i> | 24 to 28 July 2022 | 13th International Conference on Applied Human Factors and Ergonomics <i>New York, USA</i> |
| April 2022 | CIEHF: Ergonomics and Human Factors 2022 <i>11 - 12 April, Online</i> <i>25 - 26 April, Birmingham, UK</i> | 10 to 14 October 2022 | Human Factors and Ergonomics Society International Annual Meeting 2022 <i>Atlanta, USA</i> |
| 30 April to 6 May 2022 | ACM CHI 2022: Conference on Human Factors in Computing Systems <i>New Orleans, USA</i> | 14 to 15 October 2022 | 8th ErgoX Symposium <i>Atlanta, USA</i> |

Journal Special Issues

| Special Issue Title | Journal | Submission Deadline |
|---|--|---------------------|
| Safety science in the new age of work | Safety Science | 30 December 2021 |
| Applications of advanced technologies in rail safety | Accident Analysis & Prevention | 31 December 2021 |
| Human-centric production and logistics system design and management: Transitioning from industry 4.0 to 5.0 | International Journal of Production Research | 31 January 2022 |
| Distraction and road safety: Emerging issues and prevention | Accident Analysis & Prevention | 31 January 2022 |
| Human factors and ergonomics in cities, urban design and development | Human Factors and Ergonomics in Cities, Urban Design & Development | 28 February 2022 |
| Applying E/HF systems thinking to complex global problems | Ergonomics | 28 February 2022 |
| Human factors in business technology management | EuroMed Journal of Business | 31 March 2022 |

Congratulations!

Professor Paul Salmon was recently recognised by The Australian Research Magazine 2021 as the Field Leader for Quality & Reliability in the field of Engineering & Computer Science.

Based on the work by the CHFSTS, The University of the Sunshine Coast was also recognised as the Lead institution for Quality & Reliability in the field of Engineering & Computer Science for 2021.

This is two years running for Paul, and testament to the amazing research conducted by the CHFSTS team.



Recent Publications (Email chfstst@usc.edu.au if you are unable to access a publication)

- Austin, E. E., Blakely, B., Salmon, P. M., Braithwaite, J., & Clay-Williams, R. (2022). Technology in the emergency department: Using cognitive work analysis to model and design sustainable systems. *Safety Science*, 147, 105613. <https://doi.org/10.1016/j.ssci.2021.105613>
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