



MELBOURNE DEFENCE ENTERPRISE

## HumanPRIMED

### A HOLISTIC APPROACH TO ENHANCED HUMAN PERFORMANCE

*HumanPRIMED* is an active and growing community of human-centred researchers with an interest in addressing complex multi-disciplinary human performance challenges in the Defence context. Spanning four Faculties at the University of Melbourne, *HumanPRIMED* draws together biomechanists, assistive technology developers, psychologists, clinical health professionals, physiologists, mental health experts and computer scientists with a shared aim of exploring the true “integrated” (physical, physiological and cognitive) limit of human performance. *HumanPRIMED* is led by senior researchers with a deep understanding of the Defence environment and priorities and is supported by the the University’s Melbourne Defence Enterprise (MDE)

Partners can leverage the perspectives of technology and health professionals as well as world leading human performance research facilities and tools to stay at the forefront of technology implementation

### A WORKFORCE FOR TOMORROW

A cornerstone of *HumanPRIMED* is its enabling multi-disciplinary postgraduate student projects. Leveraging the University’s strong postgraduate research structure and its renowned high achieving student base, *HumanPRIMED* incubates new cross-disciplinary connection between its members while also training the Defence-centric human performance workforce of the future.

### ADDRESSING “GRAND CHALLENGES”

The unique, comprehensive and growing community of experts in *HumanPRIMED* presents an opportunity for Defence and Industry to think about human performance research questions on grander scale. *HumanPRIMED* is coordinated, has an extant understanding of Defence context and is agile to generating targeted multi-disciplinary teams with all angles covered.

### HUMAN PERFORMANCE CAPABILITIES

- Decision Science
- Complex Human Data
- Human Computer Interfaces and Teaming
- Biomechanics measurement, modelling and simulation
- Assistive Technologies
- Brain and Mental Health
- Performance Biometrics and Wearables
- Computational Neuroscience
- Physiology-based models of performance



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### MEET THE *HumanPRIMED* ACADEMIC PARTNERS

In this document we present short capability “snap shots” for each of the *HumanPRIMED* academic partners. Each capability statement succinctly summarises their background, expertise and research interests contextualised for Defence. We have further consolidated the rich and diverse topics currently addressed by *HumanPRIMED* partners into nine key “Human Performance Capabilities” and matched these key capabilities to academics throughout the document for easy reference. We expect this overarching summary of *HumanPRIMED* capability to become a living document as more partners join the initiative or when partners move on to other roles in academia or industry. We also expect that cross-disciplinary interaction will seed new capabilities that have yet to be considered in the Defence context.

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## PROF PETER LEE

### DEPARTMENT OF BIOMEDICAL ENGINEERING

#### OVERVIEW

Peter Lee is a Professor in the Department of Mechanical Engineering at The University of Melbourne. He was a Research Fellow with the Biomaterials Group at the Institute of Materials Research and Engineering, Singapore from 1998–2001. In 2001, he joined the Defence Medical and Environmental Research Institute, DSO National Laboratories, Singapore, as the Head of the Bioengineering Laboratory. He was appointed as an Adjunct Associate Professor from 2002–2008 at the National University of Singapore, Division of Bioengineering. In 2008 he joined University of Melbourne as a Senior Lecturer.

#### RESEARCH FOCUS

Prof Lee's research focuses on biomechanics of the human body, organs, tissues and cells, contributing to a wide range of interdisciplinary research fields in biomedical engineering, including biomaterials, medical devices and rehabilitation engineering. In the field of Biomechanics Prof Lee is continually working to better understand the mechanisms of injury that will lead to more effective prevention strategies. His investigations use human volunteers and computational models to advance our understanding of clinical symptoms, pathological evidence and injury. Computational studies include models of the human brain, head-neck, spine, knee, pelvis and foot. In the field of Rehabilitation Engineering, he explores the biomechanics for lower limb prostheses and orthoses. He is interested in using CAD/CAM and rapid prototyping methods for prosthetic socket manufacturing to improve artificial limb function and amputee acceptance. He is also interested in the development of new materials and methods for producing low-cost prostheses. Another area of his research is in soldier protection from shockwaves generated when a landmine or improvised explosive device detonates under an armoured vehicle. His lab is working actively with the Australian Defence Science Technology (DST) Group and the US Army Research Lab (ARL) to develop biofidelic models and injury criteria of the human spine and pelvis. He has also worked with academic and industry colleagues in structural and materials engineering to develop shock-absorbing 3D printed auxetic structures for vehicles to reduce the risk of injury to crewmembers.

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#### CONTACT:

[pvlee@unimelb.edu.au](mailto:pvlee@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



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## A/PROF DAVID ACKLAND

DEPARTMENT OF BIOMEDICAL ENGINEERING

### OVERVIEW

A/Prof Ackland is Deputy Head of the Department of Biomedical Engineering, Deputy Director of the ARC Centre for Medical Implant Technologies, and head of the Biomechanics Research group in the Department of Biomedical Engineering at the University of Melbourne.

### RESEARCH FOCUS

A/Prof Ackland's research addresses complex problems in human performance by measuring human movement, muscle activity and employing assistive technologies. He is also interested in understanding the neural signals that are responsible for human movement. His research focuses on computational modelling and experimentation in human movement and injury biomechanics. His research group employs medical imaging, human motion experiments, musculoskeletal modelling, and in vitro biomechanical experiments in the evaluation of muscle and joint function. He is particularly interested in exploring human movement, joint function and biometrics in the wearables space. Detailed information from the wearables can provide a much clearer understanding about what our muscles and joints are doing, which is critical for performance enhancement, injury prevention and rehabilitation. A/Prof Ackland is also using infrared spectroscopy and EEG to measure neural activity in combination with muscle activity. The measurement of brain function in combination with human movement gives a deeper understanding of what the individual muscles are doing to generate body movement. A/Prof Ackland is working to develop better techniques for measuring both physical and cognitive performance in order to understand a person's ability to learn or to perform a task under different conditions. A/Prof Ackland future research aspirations include exploring how brain signals and other human biometric measurements could be used to power exoskeletons, prosthetic limbs and assistive devices.

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**CONTACT:**

[dackland@unimelb.edu.au](mailto:dackland@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



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## PROF JAMES BAILEY

SCHOOL OF COMPUTER AND INFORMATION SYSTEMS

### OVERVIEW

James Bailey is a Professor in the Melbourne School of Engineering at The University of Melbourne and Program Lead for Artificial Intelligence. He is a researcher in the field of machine learning and artificial intelligence, including interdisciplinary applications and operational frameworks.

### RESEARCH FOCUS

Prof Bailey's interests particularly relate to the assurance, certification and safety of systems based on machine learning and artificial intelligence. He contributes to the AI research community through roles such as membership of Editorial Boards including the Journal of Artificial Intelligence Research, ACM Transactions on Data Science and IEEE Transactions on Big Data. Prof Bailey works on the deployment of AI systems in collaboration with a wide range of industry and government partners across the defence, energy and health sectors. He is currently leading an AI industry engagement platform in Melbourne School of Engineering. He has contributed heavily to the understanding of how machine learning is used to generating fake content. Prof Bailey is also exploring applying AI to the learning analytic space. This involves analysing data from eye tracking sensors and thermal imagery to gain a deeper understanding of how people respond to content.

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#### CONTACT:

[baileyj@unimelb.edu.au](mailto:baileyj@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



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## PROF STEVEN PRAWER

SCHOOL OF PHYSICS

### OVERVIEW

Steven Praver is Professor of Physics at the University of Melbourne. He is one of Australia's foremost authorities in physics. He has held numerous senior positions, including Director of the Melbourne Materials Institute, Node Director of the Centre of Excellence for Quantum Computing Technology (2000-2002), and Inaugural Director of the Defence Science Institute (2011). In 2015-2016 he served as scientific advisor at the National Research Council of Canada, working on developing pathways to impact for early-stage basic research. In 2010 he was elected to the Australian Academy of Science in recognition of his seminal contributions to diamond science and technology.

### RESEARCH FOCUS

Professor Steven Praver is Australia's foremost authority on the physics of diamond and related materials. His work has brought Australia to the forefront in their study and the development of applications. In particular, he has been pivotal in elucidating the fundamental nature of the interaction of energetic ion beams with these materials and has pioneered the production of a new generation of nano-scale quantum devices based on diamond. His dynamic group is one of the largest and best equipped in the world devoted to quantum diamond research. It attracts top international researchers and invitations to collaborate from all over the world. His recent results are finding application in single photon sources for quantum cryptography for secure communications and in diamond-based devices for quantum computers. Another research focus of his has been the merging of the areas of nanoscience and neuroscience to push the boundaries of bionic devices. Prof Praver's current research project looks at high resolution recording and stimulation within the brain and its importance to the development of technologies that interface electronics with the human body.

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#### CONTACT:

[s.prawer@unimelb.edu.au](mailto:s.prawer@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



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## PROF ADAM VOGEL

DEPARTMENT OF AUDIOLOGY AND SPEECH PATHOLOGY

### OVERVIEW

Adam Vogel is a Professor in the Department of Audiology and Speech Pathology at The University of Melbourne and leads the Centre for Neuroscience of Speech. He holds a PhD in behavioural neuroscience and degrees in psychology and speech science. Prof Vogel is a Humboldt Fellow at the Hertie Institute for Clinical Brain Research, co-Founder and Chief Science Officer of Redenlab Inc and continues to work as consultant speech pathologist for the Murdoch Children's Research Institute and the Eastern Cognitive Disorders Clinic.

### RESEARCH FOCUS

Prof Vogel examines speech and language biometrics to enhance decision making. He develops speech tests to guide decisions about brain function and quality of life in clinical medicine and drug development. His research also looks at using speech as a digital marker of function and performance. His model can use speech to tell us about disease, physical health deterioration as well as fluctuating levels of mental health and well-being. He can measure change in behaviour objectively using signal processing algorithms called acoustic analyses to tell us about changes in the speech signal itself. Prof. Vogel has built algorithms and developed an approach that allows him to measure speech in a way that provides quantitative data on change. He is particularly interested in exploring speech as a marker for alertness, fatigue and stress and general performance readiness. In a defence context, Prof Vogel sees particular potential impacts from his work in exploring exactly how stress impacts someone's performance and tapping into subtle changes in performance based on speech.

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#### CONTACT:

[vogela@unimelb.edu.au](mailto:vogela@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



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## PROF ANTHONY BURKITT

DEPARTMENT OF BIOMEDICAL ENGINEERING

### OVERVIEW

Anthony Burkitt is Professor of Engineering at the University of Melbourne, Department of Biomedical Engineering, where he holds the Chair of Bio-Signals and Bio-Systems. Professor Burkitt was the Director of Bionic Vision Australia (2010-2016), a Special Research Initiative in Bionic Vision Science and Technology of the Australian Research Council (ARC).

### RESEARCH FOCUS

Prof Burkitt considers himself an interdisciplinary scientist. His research encompasses a number of areas of neuroscience and medical bionics, including computational neuroscience, neuro-engineering, psychophysics, cochlear-implant speech processing and bio-signal processing for epilepsy. Prof Burkitt's research focuses on how networks of spiking neurons in the brain process information and is conducted through an analysis of the encoding, transmission and decoding of information within neuronal systems. His research and leadership led directly to the development of the bionic eye which provides prosthetic vision to blind patients. His research has specifically led to the development of improved visual stimulation paradigms for retinal implants. He has also been instrumental in the development of new cochlear implant speech processing strategies. Prof Burkitt's main research interests are in understanding how the brain both processes and learns information. His research in computational neuroscience has contributed to understanding the behaviour and function of neural information processing in the brain, encompassing both neural coding and spike-timing synaptic plasticity. He also investigates how electrical stimulation can be used for neurological disorders, including conditions such as blindness and deafness, through the development of visual stimulation paradigms for retinal implants and speech processing strategies for cochlear implants, and epilepsy – including methodology for detecting and predicting seizures and the use of electrical stimulation for seizure abatement.

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#### CONTACT:

[aburkitt@unimelb.edu.au](mailto:aburkitt@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



# MELBOURNE DEFENCE ENTERPRISE

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### PROF DAVID FORBES

#### PSYCHIATRY

#### OVERVIEW

Professor David Forbes is a clinical psychologist and international expert in post-traumatic stress disorder (PTSD) and military mental health. He is the Director of Phoenix Australia Centre for Posttraumatic Mental Health, in the Department of Psychiatry at The University of Melbourne. He has extensive experience in the assessment and treatment of mental health problems following trauma. Prof Forbes sits on the advisory committees for the Department of Veterans' Affairs and Defence and the Australian Psychological Society. He has a strong track record in leading initiatives to improve outcomes for people affected by trauma through the translation of research into effective policy and practice. He is a passionate advocate for the use of evidence-based responses following trauma in order to reduce the mental health effects on survivors, their families and communities.

#### RESEARCH FOCUS

Prof Forbes' work focuses predominantly on promoting the mental health and well-being of personnel who find themselves exposed to trauma in their work. He has a particular interest and expertise in the mechanisms of PTSD development in the military. A big part of his work in the defence space is a longitudinal resilience study which gathers data from recruitments during the first four years of service. The study is designed to better understand the factors that influence the trajectory of mental health and well-being, functioning and resilience over the course a recruit's early career. The study looks at the factors that interfere with sound mental health and well-being. Prof Forbes is very interested in extending this study to look at what factors optimise performance. Another area that he explores is attention control intervention to prevent the deterioration of mental health when personnel are discharged from the military. This work looks at re-calibrating trained attentional bias towards neutrality rather than a bias towards threat detection. Prof Forbes is also interested in using these attentional modification paradigms to actually modify and optimise performance in the defence environment. He is further interested in the development, implementation and maintenance of the defence mental health strategy. Prof Forbes sees the use of advanced technological tools (virtual reality/wearable tech/augmented reality) as a particularly useful medium to increase the impact of his mental resilience research. Of particular focus has been virtual reality (VR) with possibilities of embedding skills training into the VR environment to help recruits build the skills to respond to high levels of duress. He proposes using VR to generate a hierarchy of threat related scenarios to allow recruits to rehearse cognitive, physiological and emotional regulation strategies that can then be implemented in combat.

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#### CONTACT:

[dforbes@unimelb.edu.au](mailto:dforbes@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



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## PROF KIM FELMINGHAM

### MELBOURNE SCHOOL OF PSYCHOLOGICAL SCIENCES

#### OVERVIEW

Kim Felmingham is a Professor in the School of Psychological Sciences at The University of Melbourne and the director of the Brain and Mental Health Research Hub. She is a clinical psychologist and neuroscientist who specialises in the field of Post-traumatic stress disorder (PTSD) and has been recognised for her research examining the neural and biological mechanisms associated with PTSD.

#### RESEARCH FOCUS

Prof Felmingham's expertise covers a wide range of methodologies exploring PTSD. In an overarching sense Prof Felmingham's research focuses on finding out how to prevent trauma from developing into PTSD. She's focused on identifying the mechanisms that may lead to PTSD and developing better interventions for them. She examines mitigating factors and looks at the ways to facilitate people's well-being and mental health particularly in a workplace setting and more specifically within first responders. She conducts research examining neurobiological and psychophysiological mechanisms underlying PTSD and examines the role of sex and stress hormones in fear extinction, memory consolidation and attentional processes. In examining the key ways that people develop PTSD, Prof Felmingham explores the over consolidation of memories of trauma experiences. She is currently looking at how the acute stress response affects memory consolidation and is examining the mechanisms within that. This includes looking at attentional bias which she examines through eye tracking. She is predominantly interested in how the stress response actually interferes or effects attentional biases. Her research also examines stress hormones like cortisol and noradrenaline and looks at how they affect attention and emotional reactivity and responses. Prof Felmingham believes that if we can find out ways to mitigate the impact of stress hormones and mitigate the effect of that on memory consolidation and attentional biases in the acute phase after trauma then we've got a way of preventing the development of PTSD. One of her current trials explores using aerobic exercise to augment the treatment response to PTSD and looks at exercise as a potential way to prevent PTSD from developing.

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#### CONTACT:

[k.felmingham@unimelb.edu.au](mailto:k.felmingham@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



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## PROF ROBERT HESTER

SCHOOL OF PSYCHOLOGICAL SCIENCES

### OVERVIEW

Prof Hester is the Deputy Head of The Melbourne School of Psychological Sciences at The University of Melbourne and the Director of the Cognitive Neuroimaging Laboratory. After completing a PhD in Psychology in 2003 at La Trobe University he held two postdoctoral positions, first at The University of Dublin, from 2003-2004, and then at The University of Melbourne, from 2004-2006 as an ARC postdoctoral fellow. From 2006-2008, Prof Hester was a Senior Research Fellow in the School of Psychology at the Queensland Brain Institute, University of Queensland, before moving to The University of Melbourne as an NHMRC CDA Senior Research Fellow, followed by an ARC Future Fellowship.

### RESEARCH FOCUS

Prof Hester is a cognitive neuroscientist with research interests in the neural mechanisms that underlie control of our own behaviour and the factors that contribute to the loss of self-control. He examines the psychological processes, and the neural mechanisms underlying them, which signal the requirement for implementation of greater cognitive control. In the study of these processes he utilises fMRI in combination with a number of cognitive tasks to measure activation patterns in key brain areas implicated in reward, punishment, error, inhibition, feedback, learning and control. These studies are conducted across clinical groups (e.g. drug addiction) and across the lifespan in healthy individuals.

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#### CONTACT:

[hesterr@unimelb.edu.au](mailto:hesterr@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



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## DR JASON FORTE

MELBOURNE SCHOOL OF PSYCHOLOGICAL SCIENCES

### OVERVIEW

Dr Jason Forte is a Senior Lecturer in the Melbourne School of Psychological Sciences at The University of Melbourne and Director of the Cognitive Neuroscience Laboratory.

### RESEARCH FOCUS

Dr Forte's research is in the domain of cognitive neuroscience. His current focus is on trying to understand how we might predict cognitive performance in extreme environments and situations where people are experiencing fatigue or psychological stress. Dr Forte is particularly interested in developing models of performance at an individual level. He is examining an individual's capacity to make a decision under stress and is developing models to better understand precisely how fatigue and stress impact decision making and cognitive performance. He is interested in individual behaviour and examining how certain environments might affect different systems in the brain. He believes that measuring and monitoring different levels of cognition is critically important to understanding an individual's performance and predicting compromised performance. He recognises the huge potential of "wearables" that can be used to monitor physiological measures that correlate to stress and indicative of declines in cognitive performance. Dr Forte is looking to deploy wearables to extrapolate data in real time in actual environments to paint a clearer picture of how fatigue and stress affect performance. The data from wearables can guide decision making and determine the best predictors of performance and how to optimise performance based on knowing the individual. Dr Forte is also combining psychological and physiological data to develop individualised predictors of performance that can then be nested within integrated models at the "team" level.

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#### CONTACT:

[jdf@unimelb.edu.au](mailto:jdf@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



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## DR KATIE DAVEY

### DEPARTMENT OF BIOMEDICAL ENGINEERING

#### OVERVIEW

Dr. Katie Davey is a Lecturer in the Biomedical Engineering Department, in the School of Chemical and Biomedical Engineering at the University of Melbourne. She completed her doctoral research in functional MRI connectivity in 2011. After completing her Ph.D. Dr. Davey worked at the Defence Science Technology Group, modelling pilot cognition and aircraft control. She has also worked in finance, modelling and predicting the movement of stock prices on the S&P500. She then took a post-doctoral position at the University of Melbourne working to develop neural models of learning.

#### RESEARCH FOCUS

Dr Davey's primary research areas are in brain imaging, such as functional MRI - the acquisition and analysis of a series of low-resolution magnetic resonance images to understand brain function, and computational neuroengineering, such as developing neural models of learning with spike timing dependent synaptic plasticity (STDP) - the process by which connected neurons adapt connection strengths during learning. Within computational neuroengineering space she models how the brain learns and under what conditions neural networks form positive responses to an environment and when they diverge into other pathologies. Her work in MRI and other medical imaging technologies seeks to improve acquisition of imaging data as well as its analyses, from which she determines which brain regions contribute to achieve certain brain functions. Dr Davey applies machine learning and deep learning techniques to image acquisition and analyses. Her research uses advanced signal processing methods, in conjunction with simulation and modelling techniques, to mathematically and programmatically model cortical processes and gain insight into how we perceive and process sensory information.

Dr Davey's advanced modelling and analysis skills have been applied to a diverse range of disciplines, including human factors, in which she developed Bayesian models of pilot cognition and bias, and financial quantitative analysis, in which she modelled stock price changes to optimise investment strategies.

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#### **CONTACT:**

[catherine.davey@unimelb.edu.au](mailto:catherine.davey@unimelb.edu.au)

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## PROF MEAGHAN O'DONNELL

DEPARTMENT OF PSYCHIATRY

### OVERVIEW

Meaghan O'Donnell is a clinical psychologist, Professor in the Department of Psychiatry at The University of Melbourne and Head of Research at Phoenix Australia. She is a past president of the International Society for Traumatic Stress Studies (the premier society in the field of traumatic stress studies). She works frequently with Australian Commonwealth government departments including the Australian Department of Veterans' Affairs and the Australian Department of Defence both in a scientific advisory capacity and as investigator on research and evaluation projects.

### RESEARCH FOCUS

Prof O'Donnell's major areas of research include early interventions after trauma exposure, phenomenology of traumatic stress responses, and barriers to recovery. She has conducted a number of randomised controlled trials testing models of early psychological intervention after trauma and has expertise in running longitudinal studies of trauma survivors. As the Director of Research at the Phoenix Australia she leads a program of research that focuses on the mental health consequences of trauma exposure. Much of her work focuses on preparing first responders to operate in high-risk environments. In the context of defence, she conducts mental health research with a focus on maximising performance from a well-being perspective. She has conducted a longitudinal study of defence members from enlistment through the first five years of their career. The study had a particular focus on resilience and looked at how to keep defence personnel well in addition to developing crucial intervention strategies when personnel become vulnerable to developing psychiatric disorders. Prof O'Donnell is particularly interested in working with defence to discover what interventions can be put into place at crucial points in a soldier's career where they might be particularly susceptible to developing mental health problems. She is very interested in developing cognitive processes to protect well-being and is currently working with the Israeli defence force to develop attention bias modification processes to protect against post-traumatic stress disorder (PTSD) and other psychiatric disorders. In the future she would like to develop psychological training for elite performance roles.

### HUMAN PERFORMANCE CAPABILITIES

- Decision Science
- Complex Human Data
- Human Computer Interfaces and Teaming
- Biomechanics measurement, modelling and simulation
- Assistive Technologies
- **Brain and Mental Health**
- **Performance Biometrics and Wearables**
- Computational Neuroscience
- Physiology-based models of performance

#### CONTACT:

[mod@unimelb.edu.au](mailto:mod@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



# MELBOURNE DEFENCE ENTERPRISE

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## PROF SIMON DENNIS

DEPARTMENT OF PSYCHOLOGICAL SCIENCES

### OVERVIEW

Professor Simon Dennis is the Director of the Complex Human Data Hub (CHDH) in the Melbourne School of Psychological Sciences at The University of Melbourne. He is also the Head of the Memory and Language Lab in the Melbourne School of Psychological Sciences. He has held grants from various agencies including the National Science Foundation, the Australian Research Council, the Institutes of Educational Sciences, the Air Force Office of Scientific Research, the Defense Science and Technology Organization and Defense Research and Development Canada.

### RESEARCH FOCUS

Prof Dennis's expertise is in human memory and language processing. He is also involved in information retrieval and machine learning research. His research focuses on the application of behavioural, computational and neuroscientific methods to the study of human memory and language. His research hubs primary aim is to develop Computational Behavioural Science – bringing computational methods to bear on big data to better understand psychological processes. Prof Dennis's research utilises large scale real world data, experimental paradigms and computational modelling techniques to investigate the cognitive architecture underlying memory and language. Much of his research uses “experience” sampling technologies to study psychological processes. He has created an extensive data collection, retrieval, visualization and analysis ecosystem provided by Unforgettable Research Services Pty Ltd of which he is the CEO. Prof. Dennis also has an interest in privacy and the concept of participant owned data.

### HUMAN PERFORMANCE CAPABILITIES

- Decision Science
- **Complex Human Data**
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- Brain and Mental Health
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- Computational Neuroscience
- Physiology-based models of performance

#### CONTACT:

[simon.dennis@unimelb.edu.au](mailto:simon.dennis@unimelb.edu.au)  
[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



## DR JARROD KNIBBE

### COMPUTING AND INFORMATION SYSTEMS

#### OVERVIEW

Dr Jarrod Knibbe is a Lecturer in Human Computer Interaction in the school of Computing and Information Systems at The University of Melbourne. He previously worked as a Lecturer in the Faculty of Information Technology at Monash University where he worked within the Computer Human Interaction and Creativity section. Prior to this he was a post doc in Human Centred Computing at the University of Copenhagen researching body-based user interfaces, exploring Electrical Muscle Stimulation (EMS), sense of agency and mobile interaction.

#### RESEARCH FOCUS

Dr Knibbe's research focuses on bringing emergent technologies into the real world; by (1) exploring user experience, (2) technology development, and (3) domain exploration. His work combines hardware and software development, with quantitative and qualitative studies and analysis. He employs mixed methodologies to support and develop understanding of complex phenomena and technologies. He works primarily with body-based user interfaces, exploring technologies to capture and augment both our movement and our perception of our movement. He builds wearable technologies, designs new interaction opportunities, and conducts user experience evaluations. His current research explores the limits of human performance using "soft" exosuits/garments. He is particularly interested in the potential for eTextiles and Electrical Muscle Stimulation (EMS) wearables in this space – designing and prototyping clothing with embedded stimulation electrodes that can sense and actuate the person whilst performing a given task. In this area he is working on shrinking the technologies required for muscle stimulation down purely into fabric components. A large part of his work involves trying to reduce coarse "ballistic" movements and achieve higher resolution control of muscle movement. He is currently building forearm sleeves that focus on fine finger control and exploring the interplay between the parameters of the signals and the coupling of antagonist and agonist muscles. Understanding the interplay between these two groups of muscles will likely provide the answer to achieving increased fluidity of motion through EMS. This knowledge will improve the underlying human performance by helping humans recruit the correct muscles whilst performing a given task (particularly when fatigued). Another large part of his research focuses on determining exactly which muscles need to be targeted in order to achieve a desired movement. He examines this by combining EMS (muscle writing, per se), with EMG (muscle reading). This enables him to automatically setup the system and learn which electrodes to target to achieve desired movements.

#### HUMAN PERFORMANCE CAPABILITIES

- Decision Science
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#### CONTACT:

Jarrold.knibbe@unimelb.edu.au  
defence-technologies@unimelb.edu.au



# MELBOURNE DEFENCE ENTERPRISE

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### DR HOSSEIN MOKHTARZADEH

#### SCHOOL OF BIOMDEICAL ENGINEERING

#### OVERVIEW

Dr. Hossein Mokhtarzadeh is a Technical Lead and Research Fellow in the Computer Assisted Rehabilitation ENvironment (CAREN) at The University of Melbourne and is the lead expert in the CAREN system in Australia. He received his PhD in 2014 from the University of Melbourne and M.Sc. Mech Eng. in 2004 from Sharif University of Technology and B.Sc. Mech in 2002 from the University of Tehran. He also received a prestigious fellowship from Harvard Medical School in 2015 in one of the world leading laboratories (Bouxsein Lab) working on the Framingham Heart Study to identify spinal fracture.

#### RESEARCH FOCUS

Dr Mokhtarzadeh has expertise in human-centric measurements critical to enhanced human performance and injury mitigation. His studies of human performance include neuro-biomechanical mechanisms of injuries, diseases and rehabilitation engineering. This includes studies in musculoskeletal injury, bone fractures and neuro-mechanical impairments (ageing and disease). He is also focussed on issues arising from human interaction with emerging technologies (human-machine/human-brain interactions) in high risk environments. He has facilitated the integration of low noise Electroencephalogram (EEG) data collection/analysis and “dual-tasking” test paradigms into the CAREN test system which along with other bio-measures will help to predict and probe the true limits of “integrated” (Physical/Physiological/Cognitive) human performance. In collaboration with his colleagues at Harvard, he has also been working on Open Source platform to provide detailed and well-validated musculoskeletal models of the thoracolumbar spine and musculoskeletal loading. He is currently working on the DST/Defence HPRnet project “Partnership in Assistive Technology Innovation” (PATI) which is exploring exoskeleton systems for performance enhancement and injury mitigation. In PATI he has developed a computational model that determines individualised augmentation requirements - achieved by combining human motion data with the mechanical properties of assisted technology to produce interaction analyses. performance. He is also developing models that can consider the “aging effect” (across age ranges) on muscles, bones and the brain – an area he believes is particularly understudied in Defence and Sports contexts. Dr Mokhtarzadeh is contributing heavily, through the development of predictive in-silico models and experimental test method development, to the realisation of a new military helmet concept with Defence Industry (under a Defence Innovation Hub program). The helmet is intended to better protect critical brain regions during an explosive blast threat scenarios.

#### HUMAN PERFORMANCE CAPABILITIES

- Decision Science
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#### CONTACT:

[mhossein@unimelb.edu.au](mailto:mhossein@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



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## A/PROF ADAM BRYANT

DEPARTMENT OF PHYSIOTHERAPY

### OVERVIEW

A/Prof Bryant is an Associate Professor of Physiotherapy at The Melbourne School of Health Sciences at The University of Melbourne. He is a clinical biomechanist and Biomedical Fellow and has published almost 70 peer-reviewed articles in leading journals.

### RESEARCH FOCUS

A/Prof Bryant's research has focused on the neuromuscular-biomechanical factors contributing to the development of early knee osteoarthritis in young people having undergone knee ligament reconstruction. His current research project aims to develop a novel athletic shoe that can reduce harmful knee loads during sport in adolescent girls and young women. The project will develop a new ASICS shoe that will be 'field-tested' during sporting activity with high knee ligament injury risk (netball) to evaluate its effect on tibial shock (in-field surrogate measure of knee load) and player comfort compared to a conventional shoe. Expected outcomes include reduced healthcare costs associated with the treatment of serious knee injury, including surgical reconstruction and early-onset knee osteoarthritis. Another project A/Prof Bryant is working on aims to improve walking performance in the aftermath of a Traumatic Brain Injury (TBI). He has developed new strengthening exercises which focus on how quickly the muscles can contract, rather than just how strong they are. These exercises can increase muscle power by 60-74% and are likely to improve people's ability to walk.

### HUMAN PERFORMANCE CAPABILITIES

- Decision Science
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#### CONTACT:

[albryant@unimelb.edu.au](mailto:albryant@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



# MELBOURNE DEFENCE ENTERPRISE

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## DR KADE PATERSON

DEPARTMENT OF PHYSIOTHERAPY

### OVERVIEW

Dr Kade Paterson is a NHMRC Emerging Leadership Fellow and a Senior Research Fellow with the Centre for Health, Exercise and Sports Medicine (CHESM) at The University of Melbourne. He is an Executive Board member and Victorian Director for the Australasian Academy of Podiatric Sports Medicine and is on the Victorian State Council for Sports Medicine Australia. He is currently the Sports Podiatrist for Melbourne United basketball club, and he was previously a biomechanical consultant for the Collingwood Football Club.

### RESEARCH FOCUS

Dr Paterson's research focuses on lower limb biomechanics for injury prevention, injury prediction and treatment. He has a special interest in the clinical and biomechanical effects of foot-based interventions for musculoskeletal conditions such as knee and foot osteoarthritis. He is also undertaking work that is looking at other knee and foot injuries, typically joint based injuries such as to the anterior cruciate ligament (ACL), that can lead to osteoarthritis. He is primarily focused on foot-based interventions but is also exploring exercise and platelet-rich plasma (PRP) for injury treatment. Within the foot-based intervention space, Dr Paterson looks at footwear and footwear-based modifications that alter loads in the joints and muscle activity patterns. He also looks at insoles and knee braces which are designed to manipulate loads coming into the body to prevent injury to soft tissues and joints. Through the CHESM he has the capability to design interventions and test them in the lab and also go out and test them on a large-scale population. He is interested in working with ADF recruits and looking at loading in standard issue equipment and seeing if that is associated with injury risk over time. He is particularly interested in field base testing with instrumented insoles. He is also interested in customising insoles and braces for active soldiers with existing injuries to improve their biomechanics in order to reduce pain and prevent muscular skeletal injury.

### HUMAN PERFORMANCE CAPABILITIES

- Decision Science
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#### CONTACT:

kade.paterson@unimelb.edu.au  
defence-technologies@unimelb.edu.au



# MELBOURNE DEFENCE ENTERPRISE

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## A/PROF ANDREW PERFORS

SCHOOL OF PSYCHOLOGICAL SCIENCES

### OVERVIEW

Andrew Perfors is an Associate Professor at the Melbourne School of Psychological Sciences at The University of Melbourne and the Deputy Director of the Complex Human Data Hub where he runs the Computational Cognitive Science Lab.

### RESEARCH FOCUS

A/Prof Perfors' research focuses on quantitative approaches to higher-order cognition: categorisation, concepts, language learning, decision-making, and cultural and social evolution and change. He uses a combination of computational models and experiments to understand the why and the what within these topics. The questions that his research looks to answer include; what goals are human learners and reasoners trying to achieve in particular situations, what constraints (cognitive, informational, environmental) do they operate under, how do these factors shape their behaviour, both on an individual and a group level? A/Prof Perfors' active projects investigate (a) the origin of our thinking and learning biases using state-of-the-art mathematical models and sophisticated experimental designs; and (b) how humans learn from each other, and how the process of information sharing shapes our choices and the information environment we live in. Expected outcomes include (a) bridging the gap between human and machine learning by pairing mathematical modelling with experimental work, forming a necessary step toward the development of machine systems that can reason like people do; and (b) gaining a better understanding of the link between individual cognition and emergent social phenomena (e.g., the rise of misinformation), thus improving our ability to intervene on and influence these complex situations.

### HUMAN PERFORMANCE CAPABILITIES

- **Decision Science**
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#### **CONTACT:**

[andrew.perfors@unimelb.edu.au](mailto:andrew.perfors@unimelb.edu.au)  
[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



# MELBOURNE DEFENCE ENTERPRISE

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### DR KRIS EHINGER

#### COMPUTING AND INFORMATION SYSTEMS

#### OVERVIEW

Dr Krista Ehinger is a Senior Lecturer in the School of Computing and Information Systems at the University of Melbourne. Prior to this she was a VISTA postdoctoral fellow in the lab of James Elder at the Centre for Vision Research at York University, and a postdoctoral fellow in the lab of Jeremy Wolfe at Brigham & Women's Hospital, Harvard Medical School.

#### RESEARCH FOCUS

Dr Ehinger's work focuses on the intersection of human and computer vision for tasks such as scene recognition, visual search and depth perception in natural scenes. She is interested in developing computer vision algorithms which can visually interpret scenes for place recognition and navigation and use scene context to support object detection and recognition. She is also interested in how these processes occur in the human visual system. Her work combines computational modelling, including Bayesian models and deep neural networks, with behavioural methods, including psychophysics, eye tracking, and large-scale online experiments. Her primary goal is to build computer models that can more effectively support humans and also explain how humans perform visual tasks. She investigates what humans are doing on a computational level and then designs the computer so that it either replicates or complements a human. She has applied this expertise on a project with the Canadian NRC Flight Research Laboratory developing better algorithms to help operators find crashed airplanes in the Canadian wilderness. In addition to this, Dr Ehinger is developing computer systems that can camouflage targets. She is interested in solving problems that involve search and attention, particularly computer-assisted search problems that require an understanding into how the human is going to work with computer assisted technology. Dr Ehinger is looking to branch out into slightly bigger problems in spatial awareness and perception including exploring how people build cognitive maps of their environment and how people navigate. She will be developing computer systems that can assist humans with navigation and spatial awareness.

#### HUMAN PERFORMANCE CAPABILITIES

- **Decision Science**
- Complex Human Data
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- Physiology-based models of performance

#### CONTACT:

[kris.ehinger@unimelb.edu.au](mailto:kris.ehinger@unimelb.edu.au)  
[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



# MELBOURNE DEFENCE ENTERPRISE

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## DR EDUARDO VELLOSO

SCHOOL OF COMPUTING AND INFORMATION SYSTEMS

### OVERVIEW

Dr Velloso is a creative technologist working as a Senior Lecturer and Researcher in the School of Computing and Information Systems and the University of Melbourne. Prior to this he was a Research Fellow at the Microsoft Research Centre for Social and Natural User Interfaces. He holds a PhD in Computer Science from Lancaster University and a BEng in Computer Engineering from the Pontifical Catholic University of Rio de Janeiro.

### RESEARCH FOCUS

Dr Velloso is part of a world-leading group of Human-Computer Interaction (HCI) researchers who study, teach and are fascinated by issues arising from humans interacting with emerging technologies. The group has strong foundations in both qualitative and quantitative methods and brings together cutting-edge technology design with development. Dr Velloso's research focuses on designing novel interactions for emerging technologies. His research uses novel devices, sensors, and actuators to create interactive experiences that help students and knowledge workers make the most of the time they spend learning and thinking. His approach combines elements of computer science, engineering, design, and psychology and is part of the rapidly emerging field of study into human-computer interactions, particularly human-AI interactions. His work also explores both how to optimise cognitive engagement and also how to recognise when and why it begins to fail. Combining studies in eye movement with cognition, he is keen to bring insights from cognitive sciences to inform the design of interactive systems for learning and work. His latest work has investigated systems that respond to users' attention patterns, gaze-based control of interactive systems, human-centred explainable artificial intelligence, and embodied interactions in mixed reality.

### HUMAN PERFORMANCE CAPABILITIES

- **Decision Science**
- **Complex Human Data**
- **Human Computer Interfaces and Teaming**
- Biomechanics measurement, modelling and simulation
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- Brain and Mental Health
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- Computational Neuroscience
- Physiology-based models of performance

#### CONTACT:

[eduardo.velloso@unimelb.edu.au](mailto:eduardo.velloso@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



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## DR BENJAMIN TAG

SCHOOL OF COMPUTING AND INFORMATION SYSTEMS

### OVERVIEW

Dr Tag is a Research Fellow and Associate Lecturer in ubiquitous computing in the School of Computing and Information Systems at The University of Melbourne. He completed his Ph.D. at the Graduate School of Media Design at KEIO University in Japan, in March 2019.

### RESEARCH FOCUS

His research interest is in the fields of ubiquitous computing and cognition-aware systems. He is investigating ways to understand human cognition by combining methods from the fields of cognitive psychology and pervasive computing. Specifically, he is interested in using ubiquitous technologies to augment the process of information consumption and knowledge acquisition. His recent research focuses on cognitive biases and the application of digital nudges to improve media literacy among technology users.

### HUMAN PERFORMANCE CAPABILITIES

- **Decision Science**
- **Complex Human Data**
- **Human Computer Interfaces and Teaming**
- Biomechanics measurement, modelling and simulation
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- Brain and Mental Health
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#### CONTACT:

[benjamin.tag@unimelb.edu.au](mailto:benjamin.tag@unimelb.edu.au)  
[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



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## DR TILMAN DINGLER

SCHOOL OF COMPUTING AND INFORMATION SYSTEMS

### OVERVIEW

Dr Dingler is a Computer Scientist and Lecturer at the School of Computing and Information Systems at the University of Melbourne. He holds a Ph.D. in Computer Science from the University of Stuttgart, a Master of Science Degree from the University of San Francisco, a Diploma from the Ludwig-Maximilians-University of Munich, and an Honors Degree from the Center of Digital Technology and Management at the University of Munich. Before coming to Melbourne, Tilman was a Project Assistant Professor at Osaka Prefecture University in Japan and spent some time as a visiting post-doc at the MIT Media Lab. In between his academic career, Tilman worked in Industry as an engineer at Yahoo! Inc. and Tinyco.

### RESEARCH FOCUS

Dr Dingler's research focuses on building cognition-aware technologies that help people process information more effectively and augment human cognition. In his research he focuses on applying cognitive concepts to technological opportunities: a mix of psychology, human-computer interaction, pervasive computing, and machine-learning.

## HUMAN PERFORMANCE CAPABILITIES

- **Decision Science**
- **Complex Human Data**
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### CONTACT:

[tilman.dingler@unimelb.edu.au](mailto:tilman.dingler@unimelb.edu.au)  
[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



# MELBOURNE DEFENCE ENTERPRISE

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## DR MICHELLE MAGEE

DEPARTMENT OF AUDIOLOGY AND SPEECH PATHOLOGY

### OVERVIEW

Dr Michelle Magee is Postdoctoral Research Fellow at the Centre for Neuroscience of Speech, at The University of Melbourne. She was awarded her PhD at University of Melbourne in 2012 and transitioned into assessing sleep and circadian regulation in alertness state, where she was awarded a Post-Doctoral Research Fellowship from the Cooperative Research Centre (CRC) for Alertness, Safety and Productivity in 2015.

### RESEARCH FOCUS

Dr Magee's research focuses on using speech biometrics as a marker for performance. She is currently investigating acoustic characteristics of disease, disease progression and alertness state. She investigates the use of speech signals to explore and determine if speech changes can be detected within various environments of stress, mental load and performance impairment. Her research has shown that the way we speak can tell us a lot about our performance and ability to make decisions and can provide a non-invasive low-burden method to detect changes in our core function. Dr Magee's research has previously looked in-depth at the widespread effects that inadequate sleep has on underlying brain function and the changes it makes to our performance, attention, and our ability to make decisions. This work focuses mainly on safety-critical environments where poor decisions can lead to accidents and injuries. Dr Magee is also studying acute stressor paradigms in a submariner context - using voice as a biometric measure for stress. She believes that the sort of information provided from speech has huge potential in the performance readiness context. She believes it has the potential to be used as a screening tool and can also be applied to identify those who might require more interventional approaches when under excessive strain or in a sleep impaired state. Dr Magee hopes to be able to integrate her work within existing platforms and be able to use it in concert with other simple to acquire metrics to allow us to truly define performance capacity "in-situ". Dr Magee is most interested in applying her research in the preventative space and believes the most valuable application of her research is for interventional approaches such as predicting alertness failure during safety critical tasks or to detect, monitor and prevent increased exposure to acute stresses that cause mental health disorders and Post traumatic stress responses.

### HUMAN PERFORMANCE CAPABILITIES

- **Decision Science**
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#### CONTACT:

[michelle.magee@unimelb.edu.au](mailto:michelle.magee@unimelb.edu.au)  
[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



# MELBOURNE DEFENCE ENTERPRISE

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### DR VIJAY RAJAGOPAL

DEPARTMENT OF BIOMEDICAL ENGINEERING

#### OVERVIEW

Dr Vijay Rajagopal is a Senior Lecturer at the Department of Biomedical Engineering at The University of Melbourne. His PhD research pioneered the development of patient-specific and anatomically accurate models of the breast for breast cancer image analysis applications. He has conducted leading edge studies that seek to understand the sub-cellular mechanisms of heart disease and cancer metastasis using microfluidics approaches.

#### RESEARCH FOCUS

Dr Rajagopal has a broad range of expertise in bioengineering spanning image analysis, biomechanics and mechanobiology, and systems and computational biology. The expertise within his lab is deep learning computer vision and capabilities in high performance computing and physics-based computer modelling as well as capabilities in bioinformatics data analyses. Dr. Rajagopal's main research interests are in understanding biological remodelling: how cells integrate chemical and mechanical signals to adapt and maintain organ function. He develops anatomically and functionally detailed computer models of cells and tissues that are closely tied to clinical data and experimental measurements. These models can be used to study fundamental biophysical mechanisms underlying biological remodelling. His main interest is in using engineering approaches to further understand particularly how the heart works and use this knowledge to develop more localised treatments and better human performance strategies. He has capabilities to build in-silco models of hearts and other organs. He can generate 3D models of a patient's heart and provide accurate information about what the heart is doing in terms of blood flow, elasticity etc. He has computer models that can simulate low oxygen environments, increased heart rate, and examine how the blood flow in that specific person's heart responds to different test. In this space he can investigate the performance of cardiac tissues in different environments and also explore the limits of the heart until failure. He is also interested in extracting biometric data through wearables to feed into the model of the heart to give a real time available assessment or monitor performance. A research question that he passionate about exploring is how cells of the heart change gene transcription over time using the current conditions they're in. He is particularly interested in examining how signals get coded up in the nucleus to make the heart grow.

#### HUMAN PERFORMANCE CAPABILITIES

- Decision Science
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- **Physiology-based models of performance**

#### CONTACT:

[vijay.rajagopal@unimelb.edu.au](mailto:vijay.rajagopal@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



# MELBOURNE DEFENCE ENTERPRISE

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## A/PROF PIERS HOWE

MELBOURNE SCHOOL OF PSYCHOLOGICAL SCIENCES

### OVERVIEW

Piers Howe is an Associate Professor of Psychology in the School of Psychological Science at The University of Melbourne and the Director of The Vision, Cognition and Behaviour Lab.

### RESEARCH FOCUS

In an overarching sense A/Prof Howe is exploring ways to optimise how humans and artificial intelligence (AI) can work together more effectively. He investigates how AI can complement and augment human capabilities rather than replacing them. His work aims to help create a collaborative intelligence where humans and AI actively enhance each other's complementary strengths and to look at ways that AI systems can be trained to best interact with humans. In the defence space he foresees an increasing number of decisions will be made autonomously and that there will be a critical need to improve the accuracy of decisions and improve trust in the machine to make these decisions. He is interested in 'light touch' explainable AI (XAI) – how to present/generate better explanations of AI decisions/solution to the human in the loop such that there is greater acceptance and trust. This will allow human and AI systems to “team” in an optimal manner. A/Prof Howe specialises in the human elements of these systems, designing the human experiments and testing the human elements for trust calibration. One of the things he is currently exploring is machine personalities and exploring ways to change the personality of a machine to better match the personality of the human operator. He takes a human centred approach to understanding what the personalities are and what we mean by personalities in this space. He is developing methods to quantify machine personalities in order to achieve compatibility with a human operator and thus to calibrate trust correctly. His work aims to better explain what humans want from a machine and how they will interact with AI to produce an idealised performance partnership.

### HUMAN PERFORMANCE CAPABILITIES

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#### CONTACT:

[pdhowe@unimelb.edu.au](mailto:pdhowe@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



# MELBOURNE DEFENCE ENTERPRISE

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## DR NATALIA EGOROVA

SCHOOL OF PSYCHOLOGICAL SCIENCES

### OVERVIEW

Dr Natalia Egorova is a Research Fellow based at the Melbourne School of Psychological Sciences at the University of Melbourne. She holds an Honorary appointment at the Florey Institute of Neuroscience and Mental Health. Previously, she was a Postdoctoral Fellow at the University of Geneva and a Postdoctoral Fellow at the Massachusetts General Hospital and Harvard Medical School. She completed a PhD in cognitive neuroscience at the University of Cambridge and Medical Research Council Cognition and Brain Sciences.

### RESEARCH FOCUS

Dr Egorova studies how pain affects cognition and how cognition shapes pain perception. She is interested in understanding how placebo and nocebo effects emerge, how sensory words are learned, how pain perception is modulated by social observation. She has a varied research portfolio spanning the fields of language, pain, stroke and depression, interrogated with neuroimaging, including task and resting state, time and frequency-resolved approaches, as well as brain stimulation. Dr Egorova started the Pain and Cognition Neuroimaging Lab, where she focuses on using experimental pain stimulation to unveil specificities of brain functioning in healthy participants and in clinical populations (psychiatric and neurological). She investigates the neurobiology of sensory word learning and pain sensitivity in depression. She also studies patterns of post-stroke neurodegeneration and brain functional decline associated with language deficits. The findings from her studies create opportunities for future translation and have led to several novel interventions – a new aphasia therapy, neuromodulation of placebo/nocebo effect in chronic pain, and physical exercise intervention in stroke.

### HUMAN PERFORMANCE CAPABILITIES

- **Decision Science**
- Complex Human Data
- Human Computer Interfaces and Teaming
- Biomechanics measurement, modelling and simulation
- Assistive Technologies
- **Brain and Mental Health**
- Performance Biometrics and Wearables
- Computational Neuroscience
- Physiology-based models of performance

#### CONTACT:

[natalia.egorova@unimelb.edu.au](mailto:natalia.egorova@unimelb.edu.au)  
[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



# MELBOURNE DEFENCE ENTERPRISE

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## PROF ANDREW METHA

DEPARTMENT OF OPTOMETRY AND VISION SCIENCES

### OVERVIEW

Andrew Metha is currently an Associate Professor in the Department of Optometry and Vision Sciences at the University of Melbourne. A/Prof currently holds a therapeutically endorsed optometry registration in Australia and maintains clinical practice through the University optometry training clinics. He joined the University of Melbourne department in 2000 after serving postdoctoral positions in Montreal (McGill Vision Research Unit), the University of Rochester's Centre for Visual Science and the Psychobiology Laboratory in Canberra's Australian National University.

### RESEARCH FOCUS

A/Prof Metha is an eclectic vision scientist with expertise in psychophysical methods of understanding visual processes. He examines single and multi-cell electrophysiological recordings in the visual cortex to investigate adaptation and brain plasticity, and most recently used adaptive optics to directly image single cells and other microstructure in living eyes. A/Prof Metha's research laboratories use adaptive optics technologies to image cellular structure and function in the living retina. The broad research aims are to understand the fundamental workings of the living retina on the microscopic scale. Of particular interest is how this becomes compromised in sight-debilitating diseases such as diabetes and glaucoma, and whether we can see early evidence in the eye for other neurological/brain conditions. The labs combine a range of investigative tools including high-resolution non-invasive imaging, psychophysics, computational modelling and electrophysiology. His current research projects make use of high speed, multi-spectral adaptive optics to visualize the smallest neurons, glial cells and blood vessels in living eyes of humans and animals. Under investigations are: the dynamics of flow and oxygen exchange at the level of individual red blood cells; the cascade of optical and physiological events that occur when a photoreceptor interacts with light; and ways to advance retinal imaging in general, exploiting the eye as a window to the brain.

### HUMAN PERFORMANCE CAPABILITIES

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- **Physiology-based models of performance**

#### CONTACT:

[ametha@unimelb.edu.au](mailto:ametha@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



# MELBOURNE DEFENCE ENTERPRISE

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## DR PATRICK GOODBOURN

SCHOOL OF PSYCHOLOGICAL SCIENCES

### OVERVIEW

Dr Goodbourn is a Postdoctoral Senior Research Fellow at the Melbourne School of Psychological Sciences at the University of Melbourne and the Director of the Genes, Brain and Behaviour Lab. His PhD, completed at the University of Cambridge, was concerned with inter-individual differences in visual and auditory perception, and how these differences can be influenced—or even determined—by our genes. He has worked as a postdoctoral researcher in the School of Psychology at the University of Sydney, studying temporal aspects of visual, auditory and tactile perception.

### RESEARCH FOCUS

Dr Goodbourn is currently working to identify mechanisms in the eye and brain that connect genetic variation to individual differences in perception and performance. In the Genes, Brain and Behaviour Lab he is investigating how normal and disordered behaviours and brain functions are affected by our genes. He is focused on understanding how our genes affect our experience of the world. Within the Lab, an interdisciplinary team of researchers use a wide range of techniques spanning molecular genetics, cognitive neuroscience and psychology to investigate the genetic basis of behaviour and brain function. The team's research examines normal variation between individuals, as well as disorders including autism and schizophrenia. By revealing the links between genes, brain and behaviour, Dr Goodbourn hopes to cast new light on the architecture and development of the mind.

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#### CONTACT:

[p.goodbourn@unimelb.edu.au](mailto:p.goodbourn@unimelb.edu.au)  
[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



# MELBOURNE DEFENCE ENTERPRISE

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## PROF CHRISTOPHER LECKIE

SCHOOL OF COMPUTER AND INFORMATION SYSTEMS

### OVERVIEW

Chris Leckie is a Professor in the School of Computing and Information Systems at the University of Melbourne. He is currently leading the University of Melbourne Academic Centre for Cyber Security Excellence. Broadly speaking his background is a mixture of research into artificial intelligence and in particular machine learning techniques, and applying those to problems in telecommunications, particularly cybersecurity problems.

### RESEARCH FOCUS

Prof Leckie has a strong interest in developing AI techniques for a variety of applications in telecommunications, such as network attack detection, network management, fault diagnosis and the Internet-of-Things. He also has an interest in scalable data mining algorithms for tasks such as anomaly detection and adversarial machine learning with application in social media analytics. His current work focuses on security analytics, in particular how we use machine learning techniques to analyse the behaviour of traffic in a network or usage of a service to detect unusual or malicious behaviour. Increasingly he is looking at how people use information in social media and how we detect unusual behaviour that might be malicious or trying to exert undue influence.

### HUMAN PERFORMANCE CAPABILITIES

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- Physiology-based models of performance

#### CONTACT:

[caleckie@unimelb.edu.au](mailto:caleckie@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)



## DR NIHARIKA GARUD

### MANAGEMENT AND MARKETING

#### OVERVIEW

Dr Garud is a senior Lecturer in Management in the Department of Managements and Marketing, Faculty of Business and Economics at The University of Melbourne. She is the Change Management Theme Coordinator at Building CRC 4.0 and Research Fellow at the Center for Asian Business & Economics.

#### RESEARCH FOCUS

Dr Garud specialises in management research and has extensive experience in management consulting. She works with organisations in various sectors to create knowledge for them to make better decisions and improve performance. Her focus is on advanced training in management research and consulting including consulting for Fortune 500 companies in Australia and internationally. She specialises in the areas of organisational psychology & behaviour, technology and innovation management, judgment and decision sciences, business analytics, quantitative modelling and statistical analyses. She also has extensive experience with written and verbal communication of research findings and technical information to diverse audiences. Dr Garud is particularly interested in R&D management (management of scientists, product development teams and processes, innovation labs) and engineering management. She is very interested in understanding how behaviours and decisions of R&D scientists and product development managers impact innovative outcomes and efficiencies in their research labs and product development divisions. She is currently working on collaborative research projects in multiple sectors funded by industry partners, including manufacturing, hi-tech, utility service providers, and medical organisations, along with conducting engaged research for several industry associations.

#### HUMAN PERFORMANCE CAPABILITIES

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**CONTACT:**

[niharika.garud@unimelb.edu.au](mailto:niharika.garud@unimelb.edu.au)

[defence-technologies@unimelb.edu.au](mailto:defence-technologies@unimelb.edu.au)