SPORTS TECHNOLOGY & APPLIED RESEARCH SYMPOSIUM

23rd November–4th December 2020

Evolution of a Perspective on Talent Pathways in Sport

MONDAY 23RD NOVEMBER 9–10AM AEDT

There's a tradition in Olympic Rowing to name the boat after someone who has had an impact on the crew. The crew that won Australia's first ever female Olympic gold medal in Rowing in 1996 named their boat, Allan Hahn. Both Megan Still and Kate Slatter came through a pioneering talent identification and development program developed by Allan Hahn and his colleagues. That program served as a template for similar programs that identified and developed athletes into Australia's Sydney Olympic campaign.

While it's been twelve years since Allan worked directly in talent identification and development, he has stayed connected with the area, and with those continuing the work, both in Australia and overseas. With 2020 hindsight, Allan will reflect on his evolving perspective on talent pathways in sport and provide some suggestions on where future work may yield competitive advantage.

PRESENTED BY:

Professor Allan Hahn OAM
PhD, B(PhysEd.)(Hons), Dip(PhysEd.)

Leader, Centre of Excellence for Applied Sport Science Research, Queensland Academy of Sport

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Allan Hahn was appointed by Dick Telford as a senior physiologist at the AIS in 1984. After the success of Allan's talent identification work, he turned his attention to altitude training where he and his colleagues conducted research that eventually led to altitude training becoming a mainstay in athlete preparation in Australia.

In 1994, Allan became Head of AIS Physiology and was part of a team of scientists that undertook extensive research into maximising performance in the hot conditions expected at Atlanta. This led to the first use of cooling vests by Australian athletes. In 1998, AIS Physiology commenced a major research project to develop a test for EPO. The work resulted in IOC approval of the test for the Sydney Olympics.

After the Sydney Olympics, Allan recognised the potential for emerging technologies to enable increased measurement of athletes in the field. He successfully led the AIS into a CRC for Microtechnology that yielded the first combined use of inertial sensors and GPS in Australian high performance sport, and laid the foundation for the establishment of spin off company Catapult Sports. Allan continues his work today in a role that guides research at the Queensland Academy of Sport.

Counting Zzzzs:

The “why?” and “how?” of sleep measurement for athletes in 2020

MONDAY 23RD NOVEMBER 4–5PM

In this session, Professor Greg Roach — from CQUniversity’s Appleton Institute for Behavioural Science — will talk about the ‘why’, ‘how’ and ‘where to’ of sleep assessment for elite athletes. In ‘why’, Greg will discuss the benefits of sleep for the athlete’s brain and body. In ‘how’, Greg will discuss the pros and cons of various techniques for assessing athletes’ sleep, including PSG, wearables and self-report. In ‘where to’, Greg will discuss ways in which sleep assessment could be used to optimise the performance of elite athletes in the future.

Greg will also provide an update on a project that his research team is currently conducting with the AIS to assess the validity of wearable technologies for assessing physiological and/or psychological measures relevant to optimising athletic performance.

PRESENTED BY:

Professor Greg Roach

BEc, Bcom, BA(Hons), PhD

Professor of the School of Health, Medical and Applied Sciences (Central Queensland University)

Sleep and Circadian Rhythms Laboratory Lead — Appleton Institute for Behavioural Science (Central Queensland University)

Greg is a Professor at the Appleton Institute for Behavioural Science, based at CQUniversity's Adelaide campus. His research interests relate to sleep and circadian rhythms, including the effects of sleep restriction/deprivation on neurobehavioural performance. Greg has conducted numerous research investigations, including the relationships between training loads, sleep quality/quantity, and sports performance in elite athletes. Greg's research is focussed on understanding the short-term and long-term consequences of poor sleep and circadian disruption, development of strategies to optimise the amount and quality of sleep, and implementing countermeasures to minimise the impact of sleep loss.

Developmental Differences in Athlete Development:

How Swimming Australia's Project H2gr0w highlights opportunity for better strategies

TUESDAY 24TH NOVEMBER 9–10AM AEDT

How can high performance sports bring research and performance staff together to address fundamental problems and improve best-practice within talent identification and development programs? In this presentation, Associate Professor Stephen Cobley (The University of Sydney) and Olympian Jamie Salter (General Manager Performance Pathway — Swimming Australia) provide insight on Project H2gr0w. Project H2gr0w, reflects a long-term applied research partnership, aimed at addressing the problem of inter-athlete developmental differences; and how such differences make athlete development challenging.

Within the presentation, Steve and Jamie will highlight (i) challenges in mobilising the project, (ii) the evidence-base informing organisation-coach level knowledge, (iii) the strategies and solutions developed, and (iv) the (un-)predicted opportunities. Altogether, they will argue Project H2gr0w is fundamentally changing coaching and swimmer programs at the representative to athlete development level, and could change participation experiences for youth swimmers more broadly in the future.

PRESENTED BY:

Associate Professor Stephen Cobley

PhD, CPsychol, AFBPsS, ASpS2

Associate Professor in the Faculty of Medicine & Health at The University of Sydney

Stephen's research interests examine the developmental factors that facilitate or inhibit learning and performance from a bio-ecological and multi-disciplinary perspective. Steve teaches units in the Exercise & Sport Science degree at Year 3 level (presently). These include Sport & Exercise Psychology (EXSS3049) as well as Motor Control & Learning (EXSS3062). Steve has published over 125 research articles and book chapters, and is co-editor of three books. Specifically, Steve co-edited "Talent identification and development: International perspectives" (Routledge, 2012), "The Routledge handbook of talent identification and development in sport" (Routledge, 2017) and "Talent identification and development: International perspectives (2nd Ed)" (Routledge, 2020). Steve's research and applied work has led to the evaluation, modification and writing of athlete development programs and policy for numerous sporting organisations.

Mr Jamie Salter OLY

BSc(ExSc)

General Manager — Performance Pathway, Swimming Australia

A former Olympic finalist, World, Commonwealth and European swimming medallist, Jamie has worked with Swimming Australia since 2013. His career history also includes 8 years at the English Institute of Sport, and experience as National Youth Development Officer for British Swimming. Jamie specialises in taking a multi-disciplinary approach to creating highly successful elite sporting environments by driving change among coaches, support staff and athletes themselves.

Performance Measurement and Tracking:

Panel-lead discussion with directed questions

TUESDAY 24TH NOVEMBER 4–5:30PM AEDT

Analyses from different national sport systems suggest relatively low 'success rates' for talent identification and talent development programs — only up to 2% of young athletes involved in TDP eventually attain international senior success' (Routledge Handbook of Talent Identification and Development in Sport: 80). The panel will discuss why this is the case, and what the Australian high performance system could consider doing to change this. The importance of athlete health and wellbeing is a critical component of this conversation.

Featuring Mr Shannon Rollason

ACT Performance Hub, Head Coach Swimming, Swimming New South Wales

Shannon Rollason is a six time Olympic Gold medal winning coach, former AIS Head Coach and inductee into Swimming Queensland's Hall of Fame. Shannon's Athens Olympic campaign in 2004 included five Olympic Gold and three World Records from both Jodie Henry and Alice Mills. After a successful stint as Head Coach at the AIS, Shannon took up the challenge of coaching in Denmark where he guided Rikke Pedersen to the world record 200m Breaststroke, the first Danish swimming world record in 60 years. Shannon also coached Jeanette Ottesen to Gold at the 2013 World Championships.

In 2016, with Shannon as coach, Denmark had their most successful swimming results with Pernille Blume winning Gold, and the Medley Relay winning bronze for the first time ever. In 2017 Shannon took up a performance coaching position at the Edinburgh University in Scotland. Shannon is currently working for Swimming New South Wales where he is the ACT Academy of Sport Head Coach at the AIS.

PANEL:

Professor Allan Hahn OAM
PhD, B(PhysEd.)(Hons), Dip(PhysEd.)

Professor Greg Roach
BEc, Bcom, BA(Hons), PhD

Associate Professor Stephen Cobley
PhD, CPsychol, AFBPsS, ASpS2

Mr Jamie Salter OLY
BSc(ExSc)

Dr Paula Charlton
BSc(Physio), M(Sports Physio), M(Musculoskeletal Physio), MExSc (Strength & Conditioning), ClinD(Physio), PhD

Mr Shannon Rollason

Preventative Athlete Health Assessments:

Measuring physical health for injury and illness prevention

WEDNESDAY 25TH NOVEMBER 9–10AM

This presentation will focus on the systems approach taken to improve athlete availability to train and compete in elite Australian Triathletes by understanding and targeting injury and illness prevention. The presentation will include processes taken to understand the problem and use of data surveillance and analysis, strategies undertaken to target the problem, and outcomes of the approach.

PRESENTED BY:

Dr Paula Charlton
BSc(Physio), M(Sports Physio), M(Musculoskeletal Physio), MExSc (Strength & Conditioning), ClinD(Physio), PhD

Performance Health Manager — Triathlon Australia

Dr Paula Charlton's role focusses on the development of systems and processes for ensuring athlete availability and optimal health as a platform for performance for elite Australian Triathletes. She has previously worked in both Olympic and Professional Sport as a Senior Sports Physiotherapist and Strength and Conditioning coach at the Australian Institute of Sport, the Melbourne Demons Football Club and Melbourne Storm Rugby Club. Paula has completed a Masters in Musculoskeletal and Sports Physiotherapy as well as a Masters in Exercise Science (Strength and Conditioning). She has also completed a Clinical Doctorate of Physiotherapy and a PhD in injury prevention in high level team sports.

Exchange Session:

Potential improvements to the ways we measure and model the athlete's developmental journey

WEDNESDAY 25TH NOVEMBER 4–5:30PM

Join a community of STARS attendees to reflect on the key messages and ideas presented in the opening days of the conference. Work together in small groups to discuss and consider how key lessons could help Australian sports improve the way in which they measure, model and enhance the developmental journey of their pathway athletes. Attendees nominating for this session will gather in the wider group before breaking out across several small think-tank groups, to share and collate thoughts and lessons from the presenters so far. STARS conference leaders/champions will facilitate each group with prompting questions and interact using virtual canvases to capture and share insights after the session.

Finding Things That Matter to Performance:

The use of deterministic modelling

THURSDAY 26TH NOVEMBER 9–10AM

In high performance sport, successful innovations are more than "shiny new things". And, innovations are more than just "technologies". Successful innovations target things that create measurable improvements to performance and the factors that contribute to it. But how do you go about targeting the things that can sufficiently change within the rules of competition and within the timeframes available for Olympic and Paralympic outcomes?

Dr Peter Vint will outline the systematic approach he takes when first engaging with a sport, to determine the things that matter most to performance. His process of identifying factors and their relationship to the performance outcome is objective and unambiguous, and strictly relies on physical, mechanical and / or mathematical principles, or on the rules and regulations of the sport itself.

In this presentation, Peter will also consider the role of research in any innovation program, and his experiences managing the interaction between the high performance environment and University academics. Finally, Peter will talk about why some innovation efforts fail in a high performance environment.

PRESENTED BY:

Dr Peter Vint
MSc, PhD

Postdoctoral fellow (Motor control), Arizona State University

Founder: MotionMax Sports Performance, Inc.

Current: Chief of Sport — USA Volleyball

Peter is an internationally renowned sports performance and analysis specialist. A rich technical background as a biomechanist and researcher preceded Peter's 10-year involvement with the United States Olympic and Paralympic Committee (USOPC) over the Beijing and London Olympic cycles. Peter became director of high performance for the USOPC from 2009-2012 after four years as a senior sport technologist from 2005-2009.

Peter then served as the USOPC senior director of competitive analysis, research and innovation from 2012-2015. In 2016, Peter was hired by Everton Football Club as the English Premier League's first American-born Academy Director. He returned to his sport science, technology and analytics consulting work in 2018, and served as Performance Team Manager for the INEOS 1:59 Challenge (held in 2019). Peter also served as subject matter expert for the Olympic Genome Project to identify and evaluate key organisational and policy factors associated with increasing medal-winning success of Olympic-sport athletes and teams.

Peter has advised in his areas of expertise for projects on international competition analysis methodologies, match and player analytics, injury surveillance, athlete data management systems, and improved implementation of sport science, motor learning, and skill acquisition.

Precision Performance Technologies:

Measurement and prediction of cognitive and physical performance

THURSDAY 26TH NOVEMBER 4–5PM

It is currently not possible to predict if someone was going to have a "bad day" or to provide immediate notifications that an individual's current level of exertion is going to lead to a loss of physical or cognitive performance. Such measures would have immediate value in elite sport and defence service personnel settings. Clearly this is a multifactorial challenge as optimal physical and psychological performance is impacted by exogenous threats, changes in endogenous physiology, or by an interaction of the two.

Unfortunately, past performance may not be a reliable predictor for current or future performance. Therefore, a solution is needed that can combine prediction of performance and real time biofeedback of multiple physiological systems and the cumulative impact these have on performance. Importantly, this information needs to produce actionable information in a timely and economical fashion. To tackle this goal a convergence science team have been assembled that draw upon advances in human physiology, psychoneuroimmunology, bioinformatics and sensor technology. This presentation will provide an overview of the key outcomes of the recently completed "performance patch trial".

The presentation will offer contextual meaning and relevance — regarding both Defence and elite sports - for the technologies that are paving the way for a future 'fit and forget' Performance Patch.

PRESENTED BY:

Australian Research Council Centre of Excellence for Nanoscale BioPhotonics; University of Adelaide Psychology; and Defence Science Technology Group

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The convergent science team of the Australian Research Council Centre of Excellence for Nanoscale BioPhotonics, University of Adelaide Psychology together with the Defence Science Technology Group (DSTG), and the Port Adelaide Football Club were supported by the Next Generation Technology Fund to undertake a study to identify biomarkers of cognitive and physical performance in elite male athletes.

The team draws upon the domain knowledge and skills of the DSTG together with the innovative new biological understanding of the connected mind and body, integrated with world class psychological assessment and molecular quantification skills. This collaborative team formed following the CNBP academic leadership of the 2018 DSTG Emerging and Disruptive Technology Assessment Symposium (EDTAS) on Human Biotechnologies. The team's goal is to create measurement technologies that provide actionable information on present threats or future challenges, allowing the precision management of human performance.

Towards Precision Engineering:

Pathways to custom equipment solutions

FRIDAY 27TH NOVEMBER 9–10AM

You've heard of precision medicine, but how do you tailor the technical needs of sports to suit individual elite athletes? AIS senior sport engineers Andy Richardson and Matt Crawford present a handful of the unique projects that produced custom equipment for Australia's elite Paralympic and Olympic athletes in 2020. Among the projects to discuss are: a new approach to wheelchair racing gloves; from complaints to custom triathlon handlebar extensions; and creating wheelchairs for Australia's top Para-athletes. Andy and Matt explore what it takes to develop the gear that helps athletes perform with confidence at their many and varied versions of 'flat gas'.

PRESENTED BY:

Andy Richardson

Senior Sport Engineer, Applied Technology & Innovation (AT&I) — AIS

Andy has been an engineer in Australia's National high performance sport system since 2018. His passion for Sport and interaction with high performance teams individuals led him to cross over from a successful career in professional motorsport engineering to Sport Engineering. Andy's background in professional motorsport provides the AIS with a high level of digital design expertise and the ability to deliver robust high performance products. During his time in the AIS AT&I department, Andy's work has encompassed delivery of customised equipment to 13 different sports, both Olympic and Paralympic. A large focus of Andy's work has been the growth of AT&I's Engineering capability, seeing a rise in staff numbers and a total overhaul of the workshop and manufacturing facility.

Matthew Crawford

Senior Sport Engineer, Applied Technology & Innovation (AT&I) — AIS

Matthew has worked alongside Australia's Paralympic and Olympic athletes for over six years following 25 years working in Motorsport Engineering across Europe & Australia. Matt has developed numerous solutions that have assisted athletes in reaching international success, including delivering projects for Dylan Alcott (Tennis), Scott Reardon (Athletics) and Erik Horrie (Rowing) to name but a few. He has a keen interest in seeing Australian Industry partnerships assist the AIS in providing world's best solutions for Australian athletes competing on the worlds stage.

Modelling Energy Expenditure and Recovery:

Investigation and validation of a three component hydraulic model

FRIDAY 27TH NOVEMBER 4–5PM

One of the very promising areas of performance modelling is the approximation of energy expenditure and recovery of an athlete during exercise. Advances in this area allow simulation of how much an athlete “has left in the tank” and to optimise rotation schemes or pacing strategies.

A theoretical concept called the “three component hydraulic model” opens up an alternative perspective on expenditure and recovery dynamics. An intuitive representation as liquid flows within tanks is coupled with a system that allows inclusion of complex parameters such as recent energy expenditure history and varying recovery conditions. Fabian discusses his work towards a pathway for transferring a thus far solely theoretical hydraulic concept to the domains of applied Sport Science to make use of its advantages in future work.

PRESENTED BY:

Fabian Weigend
MSc(Computational Visualistics)

Fabian pursues his PhD studies in collaboration with the Performance Sciences Research group and the Centre for Research in Mathematics and Data Science at Western Sydney University, Australia. His background lies in the field of computer vision which he studied in Germany and Singapore. During his postgraduate studies Fabian's focus shifted towards artificial intelligence and big-data applications. His current PhD aims to investigate opportunities in the area of performance modelling and to explore how applications in sport science can intersect with approaches in computer science in a way that is beneficial for both fields.

Practical Data Science — Data, Models, and Tall Tales

MONDAY 30TH NOVEMBER 9–10AM

The world of 'big data' is well and truly upon us. High profile success stories of data analytics include the Oakland Athletics baseball team popularised in the movie 'Moneyball' and the 2014 German world cup soccer team. However, there are many factors that contribute to successful development, integration and application of data science in an organisational context.

This presentation will reflect on a number of collaborative projects conducted in our centres, ACEMS (ARC Centre of Excellence for Mathematical and Statistical frontiers) and CDS (Centre for Data Science), and discuss potential approaches and learnings relevant to high performance sports.

Dr Paul Wu from the Queensland University of Technology's Centre for Data Science has been working with National Sporting Organisations, Queensland Academy of Sport and the AIS and his discussion will include: (i) applied modelling to address targeted needs in swimming (e.g. relay analysis and prediction), (ii) functional tests to assist in managing fatigue in training, (iii) longitudinal analysis with imagery data in health, and (iv) resilience modelling for pre-emptive management of ecosystems. These application areas cover a range of topics including data, expert knowledge, Bayesian models and detecting small effects, machine learning, longitudinal and spatial modelling, and analysis of latent (i.e. hidden) effects or patterns.

PRESENTED BY:

Dr Paul Wu
PhD, MEngSc, BEng

Industry Research Fellow, Associate Investigator (ACEMS, CDS)

Senior Lecturer in Statistical Data Science — Science and Engineering Faculty, School of Mathematical Sciences (Queensland University of Technology)

Paul is a senior lecturer in the School of Mathematical Sciences and an Associate Investigator in the Centre for Data Science (CDS) and ARC Centre of Excellence in Mathematical and Statistical frontiers (ACEMS). He is passionate about developing and applying Bayesian and machine learning methods to tackle complex, real-world problems. Paul leads a number of collaborative projects between data science researchers, applied researchers and industry practitioners, especially in ecology, and sports and physiology. His passion for collaboration has been recognised with two Vice Chancellor's awards, for industry engagement and student mentorship on engaged research.

Key, methodological interest areas for Paul include Bayesian statistics, non-homogeneous state space models, Dynamic Bayesian Networks and machine learning.

Towards Personalised Medical Implants, and the Opportunities to Better Measure, Model and Enhance High Performance Athletes

MONDAY 30TH NOVEMBER 4–5PM

The nervous system, and musculoskeletal tissues and prostheses, will have improved or degraded function depending on their neurophysiological and mechanically functional environments. These environments are the result of functionally consistent efferent and afferent neural excitation, motion and loading, and tissue biology and morphology.

Repair of musculoskeletal tissues or integration of prostheses require 'ideal' in vivo loading of tissues and appropriately designed and surgically implanted prostheses, and rehabilitation enabled with mechanically relevant real-time afferent biofeedback. In neurorehabilitation, patients must perform the intended rehabilitation consistent with appropriate patterns of muscle excitation and afferent biofeedback.

In all scenarios, implant design and surgical placement, movement assistance, muscle excitation and/or afferent biofeedback can be achieved with technologies enabled by the patient's personalised digital twin (multiscale computational simulation and AI), which will be examined in this presentation.

PRESENTED BY:

Professor David Lloyd
BSc. (Merit) (Mech Eng), PhD, FISB

Current Position: Director; Griffith Centre of Biomedical and Rehabilitation Engineering (GCORE), Menzies Health Institute Queensland

Leader — Medical; Advanced Design and Prototyping Technologies Institute (ADaPT)

David is a Biomechanical Engineer in the School of Allied Health Sciences, Griffith University, Australia. He worked in the aeronautical industry before completing a PhD in Biomechanical Engineering, then receiving a prestigious NIH Fogarty International Post-doctoral fellowship in computational biomechanics and neurophysiology at the premier Rehabilitation Institute of Chicago and Northwestern Medical School (USA). More recently, David co-founded both the Griffith Centre for Biomedical and Rehabilitation Engineering (GCORE) and Griffith's Advanced Design and Prototyping Technologies Institute (ADaPT), and now leads GCORE and ADaPT Medical.

David is a Fellow of the International Society of Biomechanics, recipient of the 2020 Geoffrey Dyson Award by the International Society of Biomechanics in Sport, ranked the 2019 Field Leader in Biophysics in Australia, and led Griffith University to be the Australian 2020 Lead Institution in Biophysics. David and team have developed computer simulation and AI methods to study the causes, prevention, and management of various neuromusculoskeletal conditions. These methods and technologies are now being adopted worldwide in laboratories, orthopaedic and neurorehabilitation industries.

The ELPSA Framework:

Measuring, modelling and enhancing educational outcomes

TUESDAY 1ST DECEMBER 9–10AM

Institutes and academies of sport have always had an educative function in support of athletes, coaches and support personnel. NSOs are also in the business of providing educational support to members, as well as their athletes and coaches. Approaches to education in our high performance system vary, and unfortunately the view that anyone can teach with the slick use of Powerpoint slides remains a common assumption. Professor Thomas Lowrie has spent a lifetime studying how people learn. Professor Lowrie will provide a useful framework to consider for anyone tasked with providing educational support in our high performance system including how to measure, model and enhance educational outcomes.

PRESENTED BY:

Professor Thomas Lowrie

Centenary Professor, Education (The University of Canberra)

Tom has an established international research profile in the discipline area of mathematics and STEM education. His body of work has focussed on the extent to which primary-aged students use spatial reasoning and visual imagery to solve mathematical problems. More recently, his research has expanded to include students' use of digital tools and dynamic imagery to solve problems and developing spatial curriculum for early years, primary and secondary classrooms.

Tom received Australian Coaching Council (Level 2) accreditation for Tennis before working in universities.

Data in Sport — Generating insight from information

Panel-lead discussion with directed questions

TUESDAY 1ST DECEMBER 4–5:30PM

The Australian high performance system celebrates its 40th anniversary on 26th January, 2021. While the national system can be proud of its medal winning achievements, there are some concerns that the system is not high performing in terms of its capabilities to collect performance data, and generate insight for the next wave of Australian athletes and coaches. This panel will discuss what is at stake if the system cannot nationally align on data collections, and what could be achieved if the system could more effectively utilise performance data.

Featuring Dr Alice Sweeting BAppSc (Hons), PhD

Research Fellow — Institute for Health and Sport, Victoria University

Alice has been a Research Fellow with Victoria University since 2016, and has been co-appointed with the Western Bulldogs Football Club. She currently co-supervises six postgraduate students who are completing their PhD projects on kicking detection, player tracking and analytics in AFL.

Alice completed her PhD in 2016 with Victoria University, Netball Australia and the AIS. Alice's PhD focused on the use of radio-frequency tracking and data mining techniques to profile the movement patterns of elite and junior-elite netball athletes. Presently, Alice is working on a number of projects in sports analytics including profiling team-sport athlete physical and skilled output using time-series analysis, detecting kicks via wearable sensors, evaluating team-sport training drills under a constraints-led approach and understanding tactical behaviours using spatiotemporal data.

Her key areas of interest include spatiotemporal data, team-sport performance and complex systems. Alice is also particularly passionate about programming in R and visualising sports analytics data. She has taught workshops on programming in R for sport scientists, and loves helping people learn how to clean, analyse and visualise their sports data.

PANEL:

Dr Alice Sweeting
BAppSc (Hons), PhD

Dr Paul Wu
PhD, MEngSc, BEng

Professor David Lloyd
BSc. (Merit) (Mech Eng),
PhD, FISB

Associate Professor
Stuart Morgan
PhD

Professor Jacqueline Alderson
BSc, PhD

Could a computer invent the Fosbury Flop?

WEDNESDAY 2ND DECEMBER 9–10AM

American high jumper Dick Fosbury upended the athletics world at the 1968 Olympic Games when he unveiled a never-before-seen technique for clearing the high jump bar. Jumping backwards over the bar seemed ridiculous, but Fosbury discovered he could jump higher using the Flop by a process of trial and error, and the technique has become universally adopted ever since.

In the modern day, Artificial Intelligence (AI) is reaching new levels of sophistication, and has been used to exploit "trial and error" algorithms to discover new strategic approaches to complex problems, from the Chinese board game Go, to the computer game StarCraft. Strategy and technique in high performance sport are similarly complex, and we ask the question, could a computer simulate game play in team sports? Could a computer use trial and error to inform and trial team strategy? Could a computer discover the Fosbury Flop?

This presentation will showcase the AIS-led Research Channel in AI, aimed at training a computer to simulate team sport strategies using real world data.

PRESENTED BY:

Associate Professor Stuart Morgan
PhD

Lead, Machine Learning, Artificial Intelligence and Data Innovation

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Stuart Morgan currently leads the AIS Applied Technology and Innovation's Machine Learning, Artificial Intelligence and Data Innovation department. Stuart completed his PhD in sensory neuroscience at Swinburne University of Technology (SUT), in 1999, and became a Research Fellow at SUT in 2000. He worked as a performance analyst at the Victorian Institute of Sport for six years, developing next-generation game analysis techniques, before joining the AIS in 2007. Stuart has worked with numerous high profile international teams including the Australian Hockey team at the 2008 Beijing Olympic Games. His current work focuses on research and development in computer vision for sports, including using data mining and machine learning techniques to gain competition and training insights.

The Numbers Matter — but which ones?

Interviewer: Barry Dancer
Interviewee: Ric Charlesworth

WEDNESDAY 2ND DECEMBER 4–5PM

The book, World's Best — Coaching with the Kookaburras and the Hockeyroos by Ric Charlesworth contains a chapter entitled, 'The Numbers Matter'. In that chapter, Charlesworth describes the perceived division between sports scientists and, '...the instinctive and pragmatic coach', where he observes that there is sometimes a tension between the 'analytical boffins' and coaches. Charlesworth points to the common high performance debate as to whether coaching is more art than science. Charlesworth proceeds to outline how the capabilities to measure performance have increased over time using various scientific methods and technologies.

In this session with Ric Charlesworth and Barry Dancer, a discussion will take place between two master coaches as to what are the numbers that matter most, and how do coaches and their support teams determine what elements of performance should be measured, modelled and enhanced.

PRESENTED BY:

Mr Barry Dancer
OLY

Barry Dancer represented Australia in field hockey at the 1976 Montreal Olympic Games, as part of the Olympic silver medal-winning team. After coaching the English men's hockey team (1997-1999) and Great Britain's hockey team at the Sydney Olympics, Barry became head coach of the Kookaburras (2001-2008). Barry coached the Kookaburras to their first ever Olympic gold medal at the 2004 Athens Olympic Games, and backed up this success with the team winning gold in the 2005 Champions Trophy. Under Barry's tactical coaching eye, the Kookaburras claimed 2 Commonwealth Games gold medals (2002, 2006), as well as the 2008 Champions Trophy gold, and the Olympic bronze medal in Beijing in 2008.

Dr Ric Charlesworth
OLY, AO, MBBS, Cit. W.A.

Ric Charlesworth represented Australia in 5 Olympic hockey teams (1972, 1976, 1980, 1984 and 1988), winning silver in Montreal in 1976. He graduated from the University of Western Australia in Medicine in 1975, having studied alongside his playing career. After serving as a member of the Hawke-Keating government for 10 years, Ric became head coach of the Hockeyroos (1993-2000) and then of the Kookaburras (2009-2014). As coach, Ric was involved in seven of Australia's nine hockey victories in the Olympics and World Cups, as well as eight out of nine Champions Trophy victories — with one bronze medal win. Ric has always strived towards innovative coaching and creating a winning culture. Having played for Australia in their 1986 inaugural World Cup win in London, Ric coached the Australian teams to four World Cup golds (Hockeyroos 1994, 1998; Kookaburras 2010, 2014). With Ric as head coach, the Hockeyroos won two Olympic gold medals (1996 and 2000), the Kookaburras won Olympic bronze in London in 2012. As one of the sharpest minds in the sport world, Ric was a giant of hockey — as a player and a coach. He has authored five books, and now mentors Australian high performance and professional sport coaches.

Future Support for Olympians:

Factories vs film production companies

THURSDAY 3RD DECEMBER 9–10AM AEDT

Australian running coach Percy Cerutty prepared Herb Elliot for the 1960 Olympic Games without much external support. As a true amateur athlete, Elliot won an Olympic Gold Medal with a World Record time in the 1500m event. Australia won a total of eight Gold Medals but the Soviet Union with their government funded athletes won 43 Gold Medals.

The Australian Institute of Sport (AIS), opened in 1981 and, in many ways, emulated Soviet Union and East German medal winning factories complete with departments that focused on facilities, coach education, talent selection, and the secret weapon - sport science. At the AIS, the scientific disciplines of physiology, psychology, nutrition, biomechanics and sports medicine focused on themes believed to confer a performance advantage. Laboratories were built and athlete assessment methodologies were refined in hopes of finding a winning edge. However, in the lead up to the Sydney 2000 Olympic Games something changed at the AIS. Funding opportunities became available for "special projects" specifically designed to help Olympic and Paralympic athletes win a medal. Funding was not directed towards improving Australia's centralised athlete support infrastructure, but instead towards performance enhancement projects that were managed more like making a movie than refining a factory. High Performance Managers worked like Film Producers, Coaches worked like Film Directors, Athletes were treated like Actors and Sport Scientists embraced high tech solutions that could solve relevant challenges, much like a special effects studio in a big budget movie.

In the animal kingdom, the concept of symmorphosis suggests that biological systems should reflect an 'economy of design'. An important question worth asking is, "Are today's Olympic / Paralympic Institutes of Sport, originally modelled off of Soviet and East German Medal Winning Factories currently ideal for attracting the brilliant coaches, innovative sport scientists and talented athletes required to win?" Or is the organisational structure and methodology adopted by some of the world's most successful film production companies more relevant? Perhaps medal winning factories are no longer a worthy analogy and instead coaches and sport scientist should be inspired by how talented teams work together to produce award winning movies.

PRESENTED BY:

Dr David T Martin

Chief Scientist Apeiron Life

Professor, Exercise Science Australian Catholic University

Former Director of Performance Research & Development (2015-2019) Philadelphia 76ers

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Dr. David T. Martin has spent the last 30 years working with Olympic and Professional Coaches and Athletes as an applied sport scientist. David has more than 110 scientific publications investigating topics such as talent identification, demands of competition, fatigue management, competition analysis, altitude training, and thermoregulation. At the AIS David was a Senior Physiologist, a National Sport Science Coordinator for Cycling, and a Director of Performance for the AIS Combat Center. David was recently the Director for Performance for the Philadelphia 76ers (2015-2019) and is currently a Chief Scientist for Apeiron Life.

Data in High Performance Sport:

Protecting while leveraging a unique national asset

THURSDAY 3RD DECEMBER 4–5PM AEDT

Recent rapid advances in AI techniques such as machine learning have occurred alongside an explosion in new wearable devices and athlete tracking and monitoring technologies. There is clear potential for historical and newly collected data from the high performance sector to be used as fuel for innovation. However, opportunities to innovate should be considered against a broader backdrop that includes examining the role and impact of data collection and usage practices within the high performance sporting system. In this presentation,

Professor Jacqueline Alderson will outline projects currently being undertaken that seek to balance the scales of innovation and the rights of athletes, organisations, and the national high performance sporting system as a whole; examining why a unified approach is essential, especially to anticipate and counter the march of Big Tech into the sporting ecosystem.

PRESENTED BY:

Professor Jacqueline Alderson
BSc, PhD

Associate Professor, Tech Director, Minderoo Tech & Policy Lab

Adjunct Full Professor (Auckland University of Technology)

As a scientist and technology innovator, Jacqueline is a regular national and international keynote speaker currently leading research teams in wearable tech, artificial intelligence and pro-public technology applications in sport and health. She is a current executive council member of the International Society of Biomechanics (ISB), and is also a fellow and former director of the International Society of Biomechanics in Sport (ISBS).

Jacqueline has an extensive community and industry engagement portfolio and among others, has collaborated with the Australian Research Council, International Cricket Council, New Zealand Accident Compensation Corporation, Australian Institute of Sport and their state based affiliates, Cricket Australia, Swimming Australia, Indian Premier League, Hockey Australia, Fremantle Dockers Football Club and VICON - the world's leading motion capture company. Jacqueline has authored/co-authored over 130 peer-reviewed textbooks, book chapters, journal papers and conference proceedings in the areas of sports performance, sports injury prevention, biomechanical modelling & machine learning.

Out of This World Human Performance:

Bringing physiological preparation for space travel back to Earth

FRIDAY 4TH DECEMBER 9–10AM AEDT

The prospect of sending people to Mars is gradually leaving the realm of science fiction and entering reality. In the world of sport, there are countless performance possibilities that humans find difficult to imagine, and problems that we find difficult to comprehend and yet are asked to solve. To achieve deep space travel, there needs to be a level of understanding of human capabilities that has never been considered before. How do you go about modelling those required capabilities?

Dr Meghan Downs and colleagues at the National Aeronautics and Space Administration (NASA) are helping to develop the capabilities that are essential to undertake the incredible journey further into space. In listening to Meg, we can ponder our own missions. Now more than ever it is crucial to reach into other areas of knowledge and thinking, to add to our own expertise, and to strive toward solving our most difficult problems with precision and thoroughness. We can ask where the similarities are in the research and modelling processes towards sending humans to Mars, and towards asking humans to propel themselves over land, through air or through water in record times.

PRESENTED BY:

Dr Meghan E. Downs
MS (Exercise Physiology), PhD (Applied Physiology)

Senior Exercise Physiologist, NASA Johnson Space Center

Dr Meg Downs has worked at NASA Johnson Space Center for over 13 years, leading research projects with multiple NASA, academia, and industry collaborators. Meg was awarded her doctorate in exercise physiology from the University of Houston, with her thesis research focusing on evaluation of a blood flow restricted exercise training study that evaluated muscle strength and local vascular and metabolic outcomes.

Meg has since conducted studies on long duration bed rest and International Space Station studies that involved developing and testing several novel protocols to test aerobic fitness and muscle strength and size. These research efforts will lead to identifying fitness requirements for mission relevant operational tasks and developing methods to assess fitness for duty for exploration missions and extravehicular activities.

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