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**Pushing the limits of polar exploration
and science - an interview with
Alan Chambers MBE**

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"There is so much opportunity presented to sport and exercise scientists by outdoor exploration in extreme environments and hardly anyone capitalises on it. Psychologically, we don't tap into adventure enough."

Alan Chambers MBE, p7

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Letters

Letter of the issue

The need for an awareness of psychosocial factors in addition to physical development

RE: [The BASES Expert Statement on Trainability during Childhood and Adolescence](#)

I read the BASES Expert Statement on Trainability during Childhood and Adolescence with interest. This area is fundamental in the design and implementation of long-term athlete development (LTAD) programmes in sport. The authors have provided a valuable statement to guide physiologists and strength and conditioning coaches with an interest in this area. National Governing Bodies (NGBs) and coaches have to contextualise and apply LTADs appropriately. The early stages are often viewed as critical as they are a time of rapid physical development. Thus, this physical development often becomes the main focus of many training programmes. However, this can result in NGBs, coaches, parents and sports scientists failing to recognise that children are not young adults. Few children truly aspire to be Olympic champions; their beliefs and attitudes reflect those of parents or coaches. They typically play sport for fun, to be with their friends and because they love to compete. Setting a good environment that focuses on psychosocial development, physical literacy and avoiding early specialisation is equally, if not more, important than physical development at a young age. Children who participate in a range of sports for enjoyment will develop aerobic endurance, speed and strength as a consequence of their participation. Specific training prescription within 'optimal windows of trainability' is probably not necessary and may contribute to the high drop-out rates from sport towards the end of adolescence. In this regard, it is essential to understand how our disciplines fit into the wider context of sport. In terms of LTAD this means having an awareness of psychosocial factors in addition to physical development. Using a wide multi-disciplinary approach that presents knowledge in a way that end-users can apply appropriately will only further the sport and exercise sciences.

- DR ANDY KIRKLAND, COACHING AND EDUCATION OFFICER, BRITISH CYCLING

Is trainability simply a physical phenomenon?

RE: [The BASES Expert Statement on Trainability during Childhood and Adolescence](#)

A comment for Prof Craig Williams and co. regarding the new Expert Statement on trainability...is trainability simply a physical phenomenon? Surely social and moral development issues are at least as important considerations as physical strength, speed etc.? Can we really aim to develop well-being in the young by reducing them to mere physical parameters?

- PROF CELIA BRACKENRIDGE OBE, FBASES

A further contribution to the trainability debate

RE: [The BASES Expert Statement on Trainability during Childhood and Adolescence](#)

We thank Dr Kirkland and Professor Brackenridge for taking interest in our expert statement and we would like the opportunity to add some further clarity to the debate. Firstly, we concur with both sets of comments that to solely place emphasis on one domain, whether it is physical, psychological, tactical or technical during Long Term Athlete Development Plans is to ignore what is a very multi-dimensional and dynamic phenomenon. Indeed, a number of the co-authors of the expert statement work with Youth Academies and we take a holistic approach to talent development for young athletes. This approach is also reflected in some of our ongoing research

in the development of life skills, wellbeing and resiliency, as well as, physical and non-physical contributors to overtraining in adolescents. Secondly, it is important to ensure that the expert statement is placed in context. It was not written to support Long Term Athlete Development Plans. We specifically set out to examine the physiological adaptations to training and whether this is influenced by maturity with a focus on 'The Trigger Hypothesis'. This hypothesis often pervades coaching theory for young athletes and their training plans and we conclude in our statement that planning intensive training around the trigger should cease. Our statement is as equally valid for a young person exercising to increase their aerobic fitness for health, as it is for a talented young sportsperson. Finally, in critically examining the evidence of the Trigger Hypothesis, we echo the words of Levine (1999) that "Far less evidence is required to establish an idea as 'fact' than is required to dislodge that fact once established" and we hope to have contributed to the trainability debate.

PROF CRAIG A. WILLIAMS FBASES, DR MELITTA MCNARRY, DR ALAN BARKER, DR RHODRI S. LLOYD, DR MARTIN BUCHHEIT AND DR JON OLIVER

BASES webinars

BASES and Human Kinetics have an agreement to run six 1-hour webinars per year. These are an efficient means of promoting research, discussing applied topics and communicating with a general audience as well as academics/practitioners. Webinars are available free to subscribers all over the world with HK having excellent promotion strategies in place alongside BASES. The most recent event *Developing resilience: From Theory to Practice* with Mustafa Sarkar (University of Gloucestershire) and Paul Morgan (Buckinghamshire New University) on 6 November 2014 attracted over 200 viewers with subscribers from UK, Ireland, Europe, USA, Canada and Australia. Mustafa Sarkar commented after his webinar, "Paul and I thoroughly enjoyed delivering the BASES webinar and sharing our knowledge and applied experiences of developing resilience in athletes. The webinar itself ran extremely smoothly. This was in part due to the support of Human Kinetics who helped with the set up and delivery of the webinar before and during the session. I would certainly recommend this experience and method of delivery. For those interested in delivering a BASES webinar, I would advise having two speakers for variety and would also suggest leaving at least 10-15 minutes for questions at the end to stimulate interaction with the listeners." The webinar is made available after the event (for 6.11.14 event see <http://bit.ly/1vT4AwK>) Information on viewer figures and their locations together with event feedback can be gained for audience figures and evidence of reach/impact. The Spring-Summer programme has planned webinars on *Practical and meaningful Biomechanics in the applied world* with Dr Phil Graham-Smith FBASES and *Rehabilitating the athlete not just the injury: The psychology of sports injury rehabilitation* with Adam Gledhill and Dale Forsdyke. If you would be interested in running a webinar please liaise with your CPD representative and see proposal template www.bases.org.uk/Webinars.

- DR ZOE KNOWLES, LIVERPOOL JOHN MOORES UNIVERSITY

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Diary dates

- 13-15 Jan. The 2015 Sports Science Summit, The O2 London
- 21 Jan. 1 day master class in Golf Psychology, Nottingham
- 22-25 Jan. FISA and British Rowing Joint Conference, Marlow
- 4 Feb. BASES Core SE Workshop, Reflective Practice for Sport and Exercise Scientists, Leeds Beckett University
- 7 Feb. Monitoring Exercise Intensity course, University of Chester
- 11 Feb. BASES Core SE Workshop, Understanding Your Client, Oxford Brookes University
- 18 Feb. BASES Core SE Workshop, Professional Ethics for Sport and Exercise Scientists, Cardiff Metropolitan University
- 21-22 Feb. 1st Association for Applied Sport Psychology (AASP) International Student Conference (sponsored by BASES), Loughborough University
- 23 Feb. BASES Workshop, Improving Your Sport Psychology Services to Parents, Loughborough University
- 26 Feb. BASES Division of Activity for Health Meeting, Coventry University
- 12-13 Mar. High Performance Conference for Paralympic Sport Science and Medicine - Ready for Rio, St. George's Park
- 21 Mar. Assessing Functional Capacity – how to administer and interpret submaximal tests in clinical populations, University of Chester
- 25 Mar. BASES Core SE Workshop, Understanding Your Client, Sheffield Hallam University
- 31 Mar-1 Apr. BASES Student Conference 2015, Liverpool John Moores University

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View from the Chair

Prof Ian G. Campbell



I am writing this article having just returned from BASES Conference 2014. This year, after a comprehensive review of our conference, we decided to change the way had been doing things in the past with a new approach and format. The decision to move away from the tradition of universities hosting the BASES Conference was

not an insignificant one for the BASES Board. However, we were delighted with the event in terms of the scientific programme, the venue and the social aspect.

The conference programme was put together by a Scientific Programme Committee chaired by Prof Clyde Williams OBE, FBASES. In my opinion the programme was packed with interesting content and insight, with an excellent variety of topics and presentation formats. I wish to thank Clyde and his team for putting together such a stimulating programme, as well as all our presenters and especially our four international speakers.

We chose the prestigious St. George's Park as the venue for the BASES Conference 2014. It provided the perfect space for our delegates to meet friends and colleagues, learn new things and share ideas. For me it really worked! Most delegates were asking if BASES Conference 2015 would be hosted there again. Watch this space!

We were delighted that the GSK Human Performance sponsored the event. I hope that this is a long lasting relationship of mutual benefit.

Day 1 finished with a gala drinks reception, kindly been sponsored by Perform at St. George's Park prior to conference dinner where Professor Greg Whyte OBE, FBASES gave an inspirational, humorous and thought-provoking pre-dinner speech. At the dinner we also honoured four new BASES Fellows, Dr Brendan Cropley FBASES, Dr Phil Graham-Smith FBASES, Dr Steve Ingham FBASES and Dr Dominic Micklewright FBASES.

Day 2 started with the opportunity of a group run! (6 made it but I didn't!) or a recovery session led by the Perform sports science team in the Hydrotherapy Suite, allowing delegates to experience how a professional athlete would use the suite to recover following competition or training. There were also opportunities for delegates to see the whole facility on special complimentary guided tours.

Throughout the event the Conference Hub was the place to be with lots of conversations taking place. I wish to thank all of our exhibitors at the conference as well as the award sponsors.

I would like to take this opportunity to thank the following individuals who played a key role in BASES Conference 2014 - Dr Claire Hitchings, Prof Clyde Williams OBE, FBASES and Jane Bairstow, as well as Jon Gordon and Adrian Eyre from The Media Group.

For those of you attended I hope you enjoyed it as much as I did and for those of you who didn't I do hope you will attend BASES Conference 2015. ■

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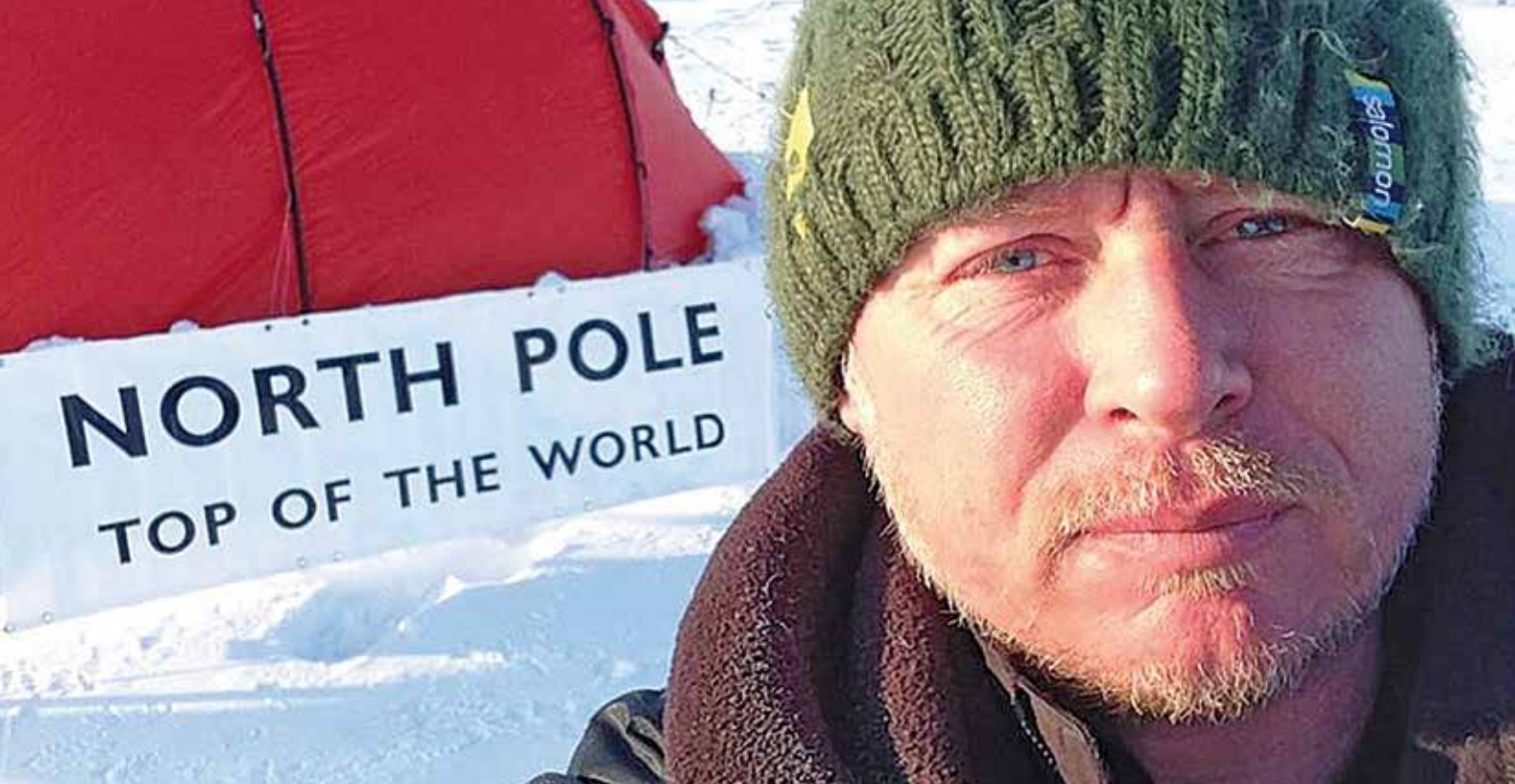
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Pushing the limits of polar exploration and science - an interview with Alan Chambers MBE

Alan Chambers MBE is an accomplished polar explorer and adventurer who successfully led the first unsupported British team to walk from Canada to the geographic North Pole. Here, Alan talks to Claire-Marie Roberts about his motivations to explore, and how outdoor adventure and sport science could benefit from a more symbiotic relationship.

Amongst his numerous expeditions to the North and South poles, Alan Chambers MBE has planned and executed the first ever winter crossing of Iceland on skis; completed the Yukon Arctic Ultra Marathon; cycled 1,800 miles from Gibraltar to the UK and has led teams on expeditions up Mount Kilimanjaro, the Himalayas and from coast to coast across Greenland. The aims of Alan's adventures are diverse. Through his expeditions, he promotes the development of key values such as leadership and personal progress. He also recognises that continued exposure to extreme environments, where the human body is pushed to its limits can provide ideal opportunities to provide data collection opportunities for the study of nutritional needs, human disease, equipment, clothing and on leadership selection. If Alan's efforts weren't enough to make even the most active person feel sedentary, he combines his passion for exploration with an opportunity to mentor others. His latest challenge involves leading the *Extreme Classroom* initiative where an annual expedition for children aged 11-16 with complex social, behavioural and/or learning difficulties helps them find their strengths, build determination, resilience and ultimately learn from life changing experiences.

Where does your passion for extreme exploration come from?

My stubbornness! As a child, I had always wanted to join the Royal Marines. When I was 14 I took on two paper rounds to help me get enough money for the gym membership I needed to prepare physically for the notorious fitness test. People told me I wouldn't

get in, but that wasn't an option for me. I signed up when I was 16 alongside 56 others. Six of us finished the 32 week training and went on to become Royal Marines Commandos. I spent 17 years serving with the Marines and throughout the course of my career I made many friends. One of my closest mates fractured his C5 vertebrae in an accident and was subsequently paralysed and became a quadriplegic. Three years later, he died as a result of an operation on his spinal cord. It was my friend's injury and subsequent bravery that compelled me to raise money to fund scientific research into recovery from damage to the spinal cord. My first money and awareness-raising idea was to lead the first team to ski across Iceland in the winter. In preparation, we blagged lunch with Princess Diana, and she consequently became a patron of the charity and of our expedition. Since this time, I've been to the North Pole 12 times, and have raised around £5.5m for a range of charitable causes.

What motivates you to continually push the limits to achieve new goals?

The places that I explore, and the expeditions I embark on. These are places where I clear my head. In the UK life is fast and hectic. People rush around at 100 miles an hour and the expectation is that you maintain that pace. I believe this means you can never give one thing 100%. When I'm exploring, it's a coping mechanism for me. A chance to escape, to be in a place where there are no distractions. I get thinking time, an opportunity to examine my outlook, to be reflective and gather some perspective. Some people view this as selfish. [Sir Ernest] Shackleton was the same. Ultimately,

I found something I am good at, and I know I can use it to give something back. Through adventure, I can help pass on the values of honesty and hard work. The *Extreme Classroom* initiatives I run give something to children that they don't get in the classroom; that attitude and approach reinforces the view that if you can put one foot in front of the other and you stick to it, you'll make it. Adventure is a great platform to teach these skills.

How have you benefited from sports science support in the preparation for, and during, recent expeditions?

My approach to preparations for my expeditions are developed and refined through experience. This probably goes against the grain of high-level sports performance. For me, it's a continuous assessment each year. What worked? What didn't work? Having said that, I do enjoy learning from my contacts from other sporting backgrounds. For example, I have shared a lot of nutrition information, leadership insights and process with people from professional Rugby Union.

How do you feel your work contributes to scientific discovery and understanding?

I am fortunate to be in a position where I am able to test a variety of different equipment, and to engineer and design things that you can't buy on the market. The cooking systems we use during exploration are designed and made in a shed in Newton Popperford [outside Exmouth]. The best mittens for extreme environments that I have worn were knitted by the Women's Institute (W.I.). A lot of the testing I do helps people cut through the marketing nonsense where the resounding message is, 'The more expensive the item, the better it is.' For me, the equipment used must help the team embrace the risks we face. To give you an example, I once tested a £5,000 tent. It was awful. It took four people 1 hour to erect. It looked good, but it was impractical. The tent I used at the North Pole cost £50. It pops up automatically, which is important if you are dealing with adverse weather conditions, or injury and illness. The fact you can be sheltered almost instantaneously in these situations builds confidence in the team. You can't put a price on this.

What do your expeditions add to our knowledge and understanding of the human body specifically?

Like [Captain Robert Falcon] Scott and [Sir Ernest] Shackleton, my expeditions are ideal opportunities to collect data on the human body. The environments and situations encountered during these adventures couldn't be more suited to data collection, but I'm surprised more people don't capitalise on it. For some of the future expeditions I am currently planning, I have been approached by a group of universities to collect data for their research into the role that bone plays in diabetes mellitus. Currently, we are also working with Tim King at De Montfort University. He will be conducting the expedition team's bio-core assessments to help us manage our posture and develop a more efficient gait. This will also include the design and fitting of special orthotic type stabilisers in our boots. Theoretically, this should alleviate stress points and even blistering in the expedition conditions and therefore improve our performance. We'll be reporting back!

How about in terms of psychology? What can sport scientists learn from your experiences in coping with extreme environments and any subsequent adversity?

There's so much to be gained from understanding the mind in the context of extreme adventure. The right attitude is key, you have to be ready to take on the challenge ahead. In these environments, you have to find a way of concentrating intensely enough to secure your and others' safety. You have to set goals, engage with them, be able to understand how to revise them when required and still maintain your drive to the end. Then there's the continuous reflection that goes on, and the leadership process. All of these things are beneficial lessons for anyone in sport science. Engaging with

challenging environments helps build resilience in individuals; how to transfer lessons like this into sport is something that warrants further attention. During expeditions I use a very specific mental approach that is personal to me. I call it the 'bright white box'. This involves me running four conversations in my head simultaneously.

Why four?

I don't like odd numbers. I have an 'immediate box' for the here and now; a 'next week box', which involves thoughts that are involved in constant planning; I have a 'dream box' - every bloke has this and a 'private box' for my private life, family etc. I lose 8 hours a day in my bright white box and I struggle to turn this off at night. The ice caps are great canvasses for the mind to run free yet it's important to maintain the ability and mental awareness to focus on any danger instantly. The 'bright white box' allows me to do both.

Sleep must be critical in your expeditions. If you are unable to turn off your 'bright white box' how do you ensure you get that rest?

I get up and write things down. I have to get up and have a cup of tea. I can't just shut off. I use ear plugs when I'm in the tent [during most expeditions]. Although it's the quietest environment, it's more psychological - I need to demonstrate to myself that I'm shutting down by using earplugs and putting a hat over my eyes. I work hard on harnessing the mind. It's important when you're on watch 18 hours a day.

What do you feel sports and exercise scientists can learn from extreme exploration?

There is so much opportunity presented to sport and exercise scientists by outdoor exploration in extreme environments and hardly anyone capitalises on it. Psychologically, we don't tap into adventure enough. The right level of mentoring and positivity can help people achieve their potential and the adventure platform provides us with this opportunity. Outdoor adventure is a £2bn business and we need to figure out how to harness this more effectively for the benefits of sport and exercise science. Ultimately, our greatest explorers approached extreme environments and gruelling physical challenges without pilates and personal trainers. They didn't have access to nutritionists, instead Shackleton for example set off to the Antarctic with 1 tonne of pipe tobacco, 3 tonnes of chocolate and a couple of hymn books. Whilst we know enough now to conclude there are more effective ways of fuelling the body for such an endurance event, this approach demonstrates the power of the mind. Something we need to look at in more detail in this context. In society, I often wonder where our spirit has gone. In different walks of life we see how easy it is to give up and throw the towel in and to a certain extent this seems to be encouraged. At the South Pole nowadays, there is a research facility, cafeteria, music room etc... and the ability to execute an exit plan - to turn back, get on a plane and head home. Great explorers never built in an exit plan - if that option wasn't there we wouldn't think about it. I want to try and encourage the removal of the exit plan - the easy option, the path of least resistance, especially when working with kids. I want to teach them that failure generates valuable lessons that help develop character and spirit. I want to help build that spirit and determination - through Shackleton's footsteps.

What next?

I'll be leading another expedition as part of the *Extreme Classroom* initiative; the fifth in a series of 8, and then planning to head South to follow in Shackleton's footsteps. ■

Interview by:

Claire-Marie Roberts, University of Worcester.

Professional and vocational qualifications considered essential or desirable for the sport and exercise scientist

Kelly Goodwin provides some advice on increasing employability.

Sport and exercise science degrees are multidisciplinary in nature providing a variety of employment opportunities. To increase employability, it is often vital to complete vocational training as an adjunct to a degree. Supplementary qualifications provide additional layers of skill and knowledge, which differentiate individual applications in a competitive labour market.

Below is a selection of courses informed by the BASES Specialist Interest Groups. Due to the cost implications, students should consider the career they would ultimately like to work in and select training as appropriate. Courses have been themed; however some are appropriate across many themes. For example, the ISAK Level One is considered valuable for those who work in the clinical exercise field, as an exercise physiologist in a football club or as an additional skill set for a personal trainer. The courses are not mutually exclusive and the mix of qualifications would depend upon an individual's career aspirations.

Health and safety training (H&S)

Depending on the career direction, individuals may need additional H&S training regarding specific hazards and how associated risks can be controlled. Consider, does the law require you to do specific training for a specific profession, i.e., first aid or phlebotomy training? For further advice, see the National Occupational Standards (www.ukstandards.co.uk), www.gov.uk for advice on skills and training and if in-house training is not sufficient visit www.oshcr.org to find an external consultant.

- **First aid certificate** - A first aid certificate is a legal requirement for the work place. Some courses cover the practical skills needed by the sports first aider instilling confidence to deal with not only lifesaving but also the management of common sports injury situations. These courses are useful for the pitch side first aider.
- **Manual handling certificate** - Employers are required to manage the risks associated with lifting, lowering, carrying, pushing and pulling equipment, etc. by ensuring staff have appropriately training in this area.
- **Personal and public liability insurance** - If working with members of the public, public liability insurance for protection against third party claims is important. Suitable policies are provided by REPs, sports coach UK, the Association for Physical Education (AFPE) and BALENS Specialist Insurance Brokers.
- **Disclosure and Barring Service (DBS)** - The DBS carries out criminal record checks for specific positions, professions, employment, offices, works and licences included in the Rehabilitation of Offenders Act 1974 (Exceptions) Order 1975. Individuals cannot apply for a check directly. However, a DBS certificate is required if working with children and if required will be requested as part of an organisation's pre-recruitment checks following an offer of employment.

Working in the coaching environment

All coaches should meet the minimum standards for active coaches as set out by sports coach UK www.sportscoachuk.org/sites/default/files/MSD-guidance-tool-1-2.pdf and would need a DBS certificate if working with children.

Recommended sports coach UK workshops:

1. **Equity in your coaching** - Course content covers the changing face of equality legislation relevant to the national equality agenda including an understanding of age, sexuality, religion, ethnicity, disability and gender.
 2. **Safeguarding and protecting children** - Course content covers the different responsibilities when caring for children as well as developing confidence about the appropriate actions to take should concerns be raised.
 3. **An introduction to FUNDamentals in movement** - Course content maps the fundamentals of movement across the National Curriculum focusing on the stages of long-term athlete development and the importance of play, fun and enjoyment in sport. Practical ideas and advice about the application of the principles of agility, balance and co-ordination are included.
 4. **What is talent?** - This is the first workshop in the Talent Foundation Series and is suitable for aspiring high-performing coaches with an interest in talent development, working, or having a desire to work with emerging athletes within the England Talent Pathway.
- **The 1st4Sport (QCF) Level 3 Certificate in Talented Athlete Lifestyle Support (TALS)** - Developed in partnership with TASS. Course content introduces the principles of supporting, advising and mentoring talented athletes in managing their personal development and lifestyle. Pre-requisite qualifications include a recognised Children Protection workshop, to have passed the UK Anti-Doping online workshop and to have access to an appropriate talented athlete over a minimum of a three-month period. Individuals without this access are still encouraged to apply.
 - **Level 2 coaching award** - In order to be a lead coach a minimum of a level two coaching award in any sport is required. With a level one coaching award, supervision will still be required.

Strength and conditioning coach (S&C)

Certified strength and conditioning specialist (CSCS) - The CSCS qualification enables the learner to design and implement safe and effective strength training and conditioning programmes and to provide guidance regarding nutrition and injury prevention. Visit: www.nscs.com/CSCS_Certification_2/

UKSCA accreditation - The UKSCA set the professional standards for strength and conditioning coaches in the UK. If you are looking for a career in this area most sport employers now stipulate ASCC accreditation as a job requirement. Visit: www.ukscs.org.uk/ukscs/common/about.asp?txtID=becomeaccredited

Working with clinical populations

For those wishing to pursue a career with a clinical focus, consider in the first instance the BASES guide to employing sport and exercise graduates in the NHS and Public Health sector: www.bases.org.uk/write/Documents/NHS_LEAFLET_FINAL.pdf

- **The International Society for the Advancement of Kinanthropometry (ISAK)** - Level one teaches basic anthropometric measurements and skinfolds. Knowledge of percent body fat is useful in health and fitness assessments and in predicting athletic performance. This course teaches how to land mark which is essential to help improve the validity and reliability of recorded measures.
- **Phlebotomy and cannulation certificate** - To test for haematological measures a Phlebotomy certificate is recommended to ensure understanding of and adherence to the proper protocols, procedures and codes of practice associated with taking human blood. An understanding of the policies for infection control, health and safety related to the task of phlebotomy and cannulation will almost always be required for ethical clearance.
- **GP exercise referral** - This course is suitable for fitness professionals who wish to work alongside a doctor and train medically referred individuals with a variety of medical conditions. The Level 3 Diploma allows for registration with the Register of Exercise Professionals (REPs) at level 3. Check with the course provider which pre-requisite qualifications are required. This course is the pre-requisite for level 4 qualifications including the Certificate in Obesity and Diabetes Management and the Certificate in Low Back Pain Management. Again, check with the various course providers which pre-requisite qualifications are required.
- **Obesity and diabetes management** - The Level 4 Diploma qualification looks at obesity and diabetes and enables the holder to prescribe, plan, conduct and review programmes to address the needs of clients allowing for the implementation of a corrective diet to aid in the management of these conditions.
- **Low back pain specialist** - A Level 4 Diploma which will allow the holder to work with clients with low back pain and to design and deliver exercise programmes to improve the health and well-being and to help alleviate these conditions. A level 4 Diploma as an obesity, diabetes or back pain specialist will allow entry at Level 4 onto REPs.
- **Corrective exercise specialist** - A qualification developed in response to the growing need for professionals to assist clients experiencing musculoskeletal imbalances requiring postural correction.
- **Cardiac rehab phase IV** - This qualification enables the holder to work with and help re-habilitate patients who have had a heart attack including those who have undergone heart surgery or previously suffered from or are suffering with any type of heart disease.
- **NHS scientist training programme (STP)** - For those *highly* committed to exploring clinical scientist training pathways consider the NHS STP. A *very competitive* graduate entry programme which leads to a more senior scientist role and to a specifically commissioned and accredited master's degree and certification of achievement of work-based training. A vast amount of preparation is required and places are limited. To find out how to prepare for such a career pathway visit: www.nhs Careers.nhs.uk/explore-by-career/healthcare-science/education-and-training/nhs-scientist-training-programme-%28stp%29/
- **Skills Active Level 4 qualifications** - It is highly desirable for graduates wishing to work with clinical populations that they attain Skills Active Level 4 qualifications, which combined with

their degree will allow individuals to apply for BASES Certified Practitioner status.

Personal training

- **Level 2 gym instructor** - This qualification is often viewed as the starting point for a career in the fitness industry and allows progression onto the Level 3 Personal Trainer qualification. Having the ability to teach the resistance based exercises considered standard for the major muscle groups of the body is invaluable for many sport and exercise scientists.
- **Level 3 personal trainer** - Advancing the knowledge from the Level 2, this qualification would enable an individual to work as a self-employed basis as a Personal Trainer specialist if so desired and allows entry at Level 3 onto REPs.

Biomechanics and Performance analysis

- **Dartfish learning technologist course** - Levels of accreditation are available (1-5) through the International Society of Performance Analysis of Sport (ISPAS). Dartfish is a comprehensive match analysis system which allows key sequences and/or moments to be found, reviewed and analysed.

Membership organisations

- American Colleges of Sports Medicine (ACSM)
- British Association for Cardiovascular Prevention and Rehabilitation (BACPR)
- British Association for Sport and Exercise Medicine (BASEM)
- British Association of Sport and Exercise Sciences (BASES)
- European College Sport Science (ECSS)
- European Society of Biomechanics (ESB)
- International Society of Biomechanics (ISB)
- International Society of Biomechanics in Sport (ISBS)
- International Society of Engineering in Sport (ISEA)
- International Society of Performance Analysis of Sport (ISPAS)
- International Society of Sport Nutrition (ISSN)
- National Academy of Sports Medicine (NASM)
- National Strength and Conditioning Association (NSCA)
- Register of Exercise Professionals (REPs)
- The Physiological Society
- United Kingdom Strength and Conditioning Association (UKSCA).

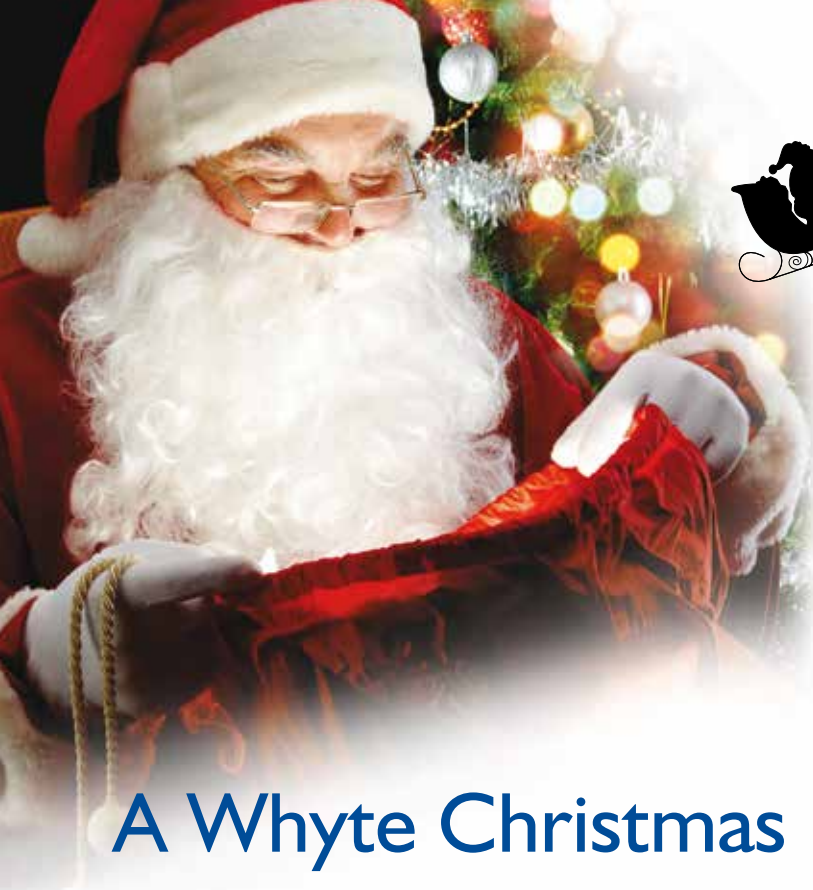
For those graduating shortly, consider the Supervised Experience/Accreditation/Certified Exercise Practitioner schemes offered by BASES. For all, consider engaging with the webinar series.

Visit REPs <http://www.exerciseregister.org/> and the ACSM <http://hfigroup.com/training/> for information about additional courses that are available. ■



Kelly Goodwin

Kelly is a Senior Lecturer at Bournemouth University, a BASES probationary sport and exercise scientist and a member of The Sport and Exercise Scientist Editorial Advisory Board.



A Whyte Christmas

Santa's future performance is safe in sports science hands!

Each year Santa Claus (aka St. Nikolas) creates a list of children who have been good throughout the year (nb. it is estimated that 90% of children are not naughty but nice). This list has nearly 2 billion names and addresses on it, of which about 33% are Christian. Accordingly, Santa has to deliver a present to c.667 million children in just a single night. With an average number of 3.5 children per household, this equates to 189 million destinations across the globe (excluding the South Pole, which is devoid of flora, fauna and young children). Given that Santa must deliver only when children are asleep (which equates to around 9 pm) in each time zone he has c.31 hours to complete his deliveries. To that end, Santa has to deliver to 1,398 houses per minute giving him c.715 μ s in which to decelerate his sleight, land, slide down the chimney, deliver presents under the tree and return up the chimney. It is estimated that the total distance travelled is in the order of 110 million miles (around the distance from the earth to the sun) requiring a speed of 3.5 million miles per hour. With these facts in mind, it is clear that Santa's annual Christmas Eve Challenge, which given the duration and speed of the event and the need to control nine reindeer (Dasher, Dancer, Prancer, Vixen, Comet, Cupid, Donner, Blixen, and Rudolph, who was only added to the team in the 20th century), can be described as a 'high intensity endurance time-trial'.

To date, Santa has succeeded in his challenge however, the UN estimates the world's population will grow by 50% to 11 billion by the end of the century. That would require Santa to deliver to almost 1 billion children! Whilst this may seem an unlikely achievement, sport scientists, and in particular sports nutritionists, have uncovered the secret to future success.

It is clear that Santa is a victim of his own success. His magical speed combined with his army of little helpers means that Santa is virtually inactive for 364 days of the year. Furthermore, thanks to his annual binge on mince pies and whiskey (or milk for those worried about his bone mineral density) together with the culinary skills of Mrs Claus, Santa's calorie consumption far outweighs his energy expenditure leading to his morbidly obese state. But fear not, with such a poor diet, sports nutrition can play a major role in enhancing his performance on Christmas Eve.

With small changes to Santa's Christmas Eve diet, sports nutritionists hold the key to improved performance. For example, caffeine will reduce fatigue and increases concentration and

alertness. Furthermore, caffeine exerts physiological effects in a number of ways, which luckily for Santa who is carrying a significant layer of insulation (nb. deliberate avoidance of the term 'fat' for fear of upsetting those of a sensitive disposition at this festive time of year!), increases fat metabolism and a decreased reliance on glycogen (Pesta *et al.*, 2013). These combined effects could improve Santa's performance by 4% (Lane *et al.*, 2014). But it doesn't stop there, carbohydrate feeding during his Christmas Eve time-trial could increase Santa's performance by helping him go 33% longer (I will leave the team at Loughborough to explain that one!) and up to a 13% improvement in his time-trial performance (Colombani *et al.*, 2013). Given the 715 μ s per household target, Santa may be hard pushed to consume adequate carbohydrates, but fear not, sports scientists have shown that he need only rinse his mouth with carbohydrates to increase his performance by 6%! (Sinclair *et al.*, 2013). In addition to the traditional and well researched performance enhancers, the new boy on the ergogenic aid block comes from an unlikely root vegetable, beetroot! Heralded by some as the golden chalice of performance enhancement during high-intensity endurance exercise, beetroot juice increases time to task failure by 14%! (Wylie *et al.*, 2014). Whilst these improvements have only been observed in recreational athletes it is clear, based upon the traditional nutrition strategy combined with sedentary behaviour, Santa could not be classed as elite!

So there we have it, our children and our children's children need not fear. Whilst the earth's population swells, Santa needs only a cocktail of carbohydrates and caffeine, and gnaw on a root vegetable to give him a performance enhancement c.50%, not to mention the potential added benefits of creatine, carnitine, sodium bicarbonate, etc. etc. So, rather than leaving mince pies and whiskey on the hearth, think about a double espresso, pasta and a beetroot salad! The only concern now is for his 4-legged friends who must look to increase their average speed closer to 5 million miles per hour. At that pace Rudolph may have more than a red nose!

Merry Christmas. ■



Prof Greg Whyte OBE, FBASES, FACSM

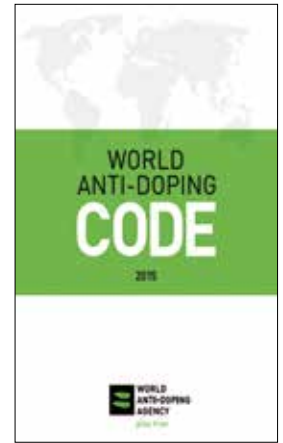
Greg is Professor of Applied Sport and Exercise Science at Liverpool John Moores University.

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2015 World Anti-Doping Code

Anne Sargent and Prof Susan Backhouse explain the 2015 World Anti-Doping Code (2015 Code) which comes into effect on 1 January 2015.



Important changes for athlete support personnel

Athlete Support Personnel (ASP), including sport and exercise scientists, play a vital role in the protection of clean sport. The 2015 World Anti-Doping Code (2015 Code) comes into effect on 1 January 2015. From this date you need to be aware of, and embrace, your new roles and responsibilities. This will allow you to continue to provide support to athletes in line with the revised Code, UK Anti-Doping Rules and the principles of clean sport.

This article provides key information on some of the main changes in the 2015 Code. Specifically, it covers your responsibilities as ASP under the Code with regards to the changing Anti-Doping Rule Violations (ADRVs) and sanctions; with a particular emphasis on supplements and inadvertent doping.

ASP and the Code

Under the 2015 Code you are asked to:

- Be knowledgeable and comply with all anti-doping policies and rules which apply to you and/or the athletes you support
- Use your influence on an athlete positively, helping to develop ethical behaviour, strong values and foster anti-doping attitudes
- Cooperate with, and support, the athlete testing programme
- Tell UKAD and your National Governing Body (NGB) or International Federation (IF) of any ADRV or similar disciplinary offence committed by you within the last 10 years
- Share information of any suspected ADRV and cooperate in any investigation - failure to do so may be treated as misconduct by your NGB and could result in disciplinary action
- Cooperate fully with UKAD and your NGB

Same risks, longer bans

There was strong support from the athletic community to increase the length of bans if an ADRV is committed. Consequently:

- Deliberate cheating using doping substances (e.g. anabolic steroids, growth hormone, EPO) and calculated doping methods such as blood transfusions will now be sanctioned with four-year bans for a first offence
- Athletes who refuse or evade testing will also be sanctioned with bans of four years
- Inadvertent doping will result, in many cases, in a two-year ban or more
- Lifetime bans from sport will still exist and can be imposed for a first offence in some cases

Protecting yourself, your athletes and your sport

The biggest cause of inadvertent doping is the careless and misinformed use of supplements:

- Athletes are likely to receive at least a two-year ban for inadvertent doping through careless supplement use
- Athletes have a responsibility to undertake thorough research of all products they are considering using before they use them
- You have a role to advise athletes accordingly, and ensure they are aware of the need, risks and consequences in relation to supplement use

Summary of key changes in the 2015 code and the UK anti-doping rules

1. ASP and the use of prohibited substances

- ASP must not use or possess a Prohibited Substance and/or Method, unless for a valid reason.

2. New ADRVs and associated changes

There will now be ten, not eight ADRVs:

- New ADRV - complicity
- If you are involved in an ADRV committed by another person (e.g. helping to cover up an ADRV) you can be sanctioned in the same way as the person who has committed that ADRV.

- New ADRV - prohibited association
- Athletes associating with an ASP, such as a doctor, sports scientist or coach who has been found guilty of either an ADRV or a criminal or disciplinary offence equivalent to an ADRV can be sanctioned with a ban
- The time period for cumulative Whereabouts violation for athletes who are part of a Registered Testing Pool is 12 months (previously 18 months)
- The statute of limitations (time in which an ADRV can be pursued) has increased from eight to ten years
- The World Anti-Doping Agency (WADA) has the power to eliminate a ban entirely and offer complete confidentiality for Substantial Assistance in exceptional cases.

3. Contaminated products

- There are specific provisions in the Code for cases involving positive tests caused by contaminated products
- If an athlete can establish 'no significant fault or negligence' in such a case, the sanction will be from a reprimand to a maximum of two years
- To get any reduction in sanction, athletes must show that they were not at significant fault or intending to cheat.

4. Responsibilities of NGBs and UKAD

- There is now a mandatory requirement for NGBs, in coordination with UKAD, to provide anti-doping education and information to athletes and ASP
- UKAD must investigate all potential ADRVs within their jurisdiction including determining whether ASP were involved in each case of athlete doping, particularly in the case of minors or groups of athletes.

5. Therapeutic Use Exemptions (TUEs)

- Athletes competing at an international level must apply to their IF for a TUE
- Athletes competing at a national level must apply to UKAD for their TUE
- International Federations and Major Event Organisers must recognise TUEs approved by UKAD if they have met the International Standard for TUEs.

Further information and support

Please contact UKAD Education and Athlete Support Team via education@ukad.org.uk or visit www.ukad.org.uk/2015-code for further information on the changes to the 2015 Code, how they may affect you, and how we can help. If you would like to join the BASES Clean Sport Interest Group (CSIG) and help shape the partnership between BASES and UKAD please contact the CSIG convener, Prof Susan Backhouse (S.Backhouse@leedsbeckett.ac.uk). ■



Anne Sargent

Anne has been working at UK Anti-Doping for over five years after studying Sport and Exercise Sciences and Sports Medicine at Exeter University. Anne's current role is Medical Education Officer within the Education and Athlete Support Team.



Prof Susan Backhouse

Sue is a Professor at Leeds Beckett University and Head of the Centre for Sports Performance. She is convener of the BASES Clean Sport Interest Group.

Light, moderate and vigorous activity; there's no absolute, it's all relative, darling!

Prof John Buckley FBASES is The Sport and Exercise Scientist's physical activity for health columnist.

Recently I attended a meeting as an advisor to a local county sports partnership on developing strategies for enhancing public engagement in nutrition and physical activity. I was being asked my thoughts on this term 'moderate intensity physical activity', but not knowing within the Chair person's documentation was Table 4 (see below) from the 2011 CMOs' report, *Start Active Stay Active*. So as a faithful sport and exercise scientist, I proceeded to describe matters in terms of relative intensity, associating the types of perceived muscle and breathing sensations that one experiences at a moderate level. I provided an example of the London Marathon, where all of the participants independent of speed, or costume worn or finishing time (from 2 hours to 5.5 hours), would generally perceive their effort to be the same 'relative' intensity. No wonder I confused them, as the CMO's Table 4 defines for all age-groups that moderate intensity lies in activities between 'absolute' values of 3 and 6 metabolic equivalents (METs); $\dot{V}O_2 = 10.5-21 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$. How did we let this happen? Thinking back to those first days of lectures on muscle metabolism, if one was a student of any decent sport and exercise programme, it was drummed into us that individualised exercise intensity is measured as 'relative' to one's maximal capacity. It seems public health policy is somewhat defying a logical scientific premise, and sets out exercise intensity (for all ages) quite unfairly for many in absolute terms. The descriptions of activities in Table 4 also seem to have a very 'middle class' feel about them, which from a health perspective is the group we need to worry about the least.

Those in our UK population who are in most need of adopting our physical activity recommendations are the very inactive, unfit, overweight/obese, less well-off and older person probably with chronic disease, which (Roberts *et al.*, 2013) if not managed correctly will increasingly be part of the 20% of the population who will soon exceed using 80% of NHS resources (NHS, 2008). Most of these people have an exercise capacity less than 6-7 METs ($\dot{V}O_{2\text{max}}$ less than $23 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$). Therefore, most activities in Table 4 would easily exceed 70% $\dot{V}O_{2\text{max}}$. In believing they were performing moderate intensity (when in fact it was vigorous) they would then attempt the challenge of accumulating 150 minutes per week and find it a struggle! Have they been mis-sold, as they actually only needed to do 75 minutes (15 minutes per day, most days of the week)? If they had participated in a local primary care health promotion initiative, the IPAQ/GPPAQ they filled in would have rated them as not being active enough to be considered healthy! Having made all that effort, the practice nurse would state they were still failing to meet an acceptable level of 150 minutes per week; talk about unnecessary de-motivation.

In further applying Table 4 using the estimated caloric expenditure values, it's all a bit disheartening for the lower fit person when they actually find out how few calories they have burned in 30 minutes! At a recent conference, I performed a small study, where I got the conference committee to use standing height tables in the main lecture hall. In two days of the conference, the committee members who stood during the sessions (at a mere additional 0.8 Calories per minute compared

Table 4. Intensities and energy expenditure for common types of physical activity

Activity	Intensity	Intensity (METs)	Energy Expenditure (Kcal equivalent, for a person of 60 kg doing the activity for 30 minutes)
Ironing	Light	2.3	69
Cleaning and dusting	Light	2.5	75
Walking - strolling, 2 mph	Light	2.5	75
Painting/decorating	Moderate	3.0	90
Walking - 3 mph	Moderate	3.3	99
Hoovering	Moderate	3.5	105
Golf - walking, pulling clubs	Moderate	4.3	129
Badminton - social	Moderate	4.5	135
Tennis - doubles	Moderate	5.0	150
Walking - brisk, 4 mph	Moderate	5.0	150
Mowing lawn - walking, using power-mower	Moderate	5.5	165
Cycling 10-12 mph	Moderate	6.0	180
Aerobic dancing	Vigourous	6.5	195
Cycling - 12-14 mph	Vigourous	8.0	240
Swimming - slow crawl, 50 yards per minute	Vigourous	8.0	240
Tennis - singles	Vigourous	8.0	240
Running - 6 mph (10 minutes/mile)	Vigourous	10.0	300
Running - 7 mph (8.5 minutes/mile)	Vigourous	11.5	345
Running - 8 mph (7.5 minutes/mile)	Vigourous	13.5	405

MET = Metabolic equivalent 1 MET = A person's metabolic rate (rate of energy expenditure) when at rest 2 METS = A doubling of the resting metabolic rate
Source: Department of Health (2004) At least five a week: Evidence on the impact of physical activity and its relationship to health. A report from the Chief Medical Officer.

to sitting (Buckley *et al.*, 2014), burned 400 more Calories over the two days compared to the majority of delegates who sat during the conference. Furthermore, it was highlighted that those who joined the obligatory conference 30 minute fun walk/run event, only burned 250-300 Calories (Ainsworth *et al.*, 2011).

So isn't it time we took a more honest look at the 150 minutes per week goal relative to the people in our population who need to be less sedentary and more active? And if we are going to exploit the use of new personalised technology to count caloric expenditure, then let's get people to focus as much, if not more, on a day's total Calories burned during more frequent light activity and promote a simple message of avoiding sitting too much. The 150 minutes per week seems to continue to be couched in terms of a fitness sport-training model, poorly understood by front-line health care professionals and the public alike. It still doesn't seem to have addressed the issue that a continual lack of any activity throughout the whole day, as opposed to defined bouts (e.g., 30 minutes) of exercise, continues to be a true culprit in our diabetogenic society (Katzmarzyk, 2010).

Proviso...

This is not however stating that we ignore the 30% of the population (15-20 million people!), who do have the social ability to participate in regular sport and exercise, where sport and exercise scientists need to be leaders and more engaged in providing value for money expert advice. ■



Prof John Buckley FBases

With more than 25 years of experience as a front-line practitioner, John, as a Professor of Applied Exercise Science in Health at the University of Chester, focuses his teaching and research on practical solutions towards enhanced practice.

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The BASES app library

COMING
SOON



We're pleased to announce a new service that will be available to BASES members in the coming months. The BASES app library provided by Our Mobile Health will help members find apps that are particularly relevant to sports and exercise science.

A general problem caused by the plethora of apps available is that it takes time to find good apps. In addition, it is often difficult to ascertain the value of an app, for example the efficacy

of an app or to know whether an app can be trusted in relation to its underpinning evidence base. The BASES library will help to overcome some of these issues, with a selection of reviewed apps for both apple and android devices, more relevant categories and an easy-to-use search functionality.

The library is a work in progress, but we are keen to get your feedback and input, so do take a look and register as a user at www.ourhealth.org.uk

We are looking for people to review apps, so if you are an avid app user and keen to share insight about apps you are using, or just intrigued and want to learn more, do get in touch at Julie.Bretland@ourmobilehealth.co.uk

Reviews - apps and books



App Name: **Sport to the Max Magazine**
App Developer: **James Hanisch @ i2net Computer Solutions**
App Cost: **£4.99**
Download at: **iTunes**
Devices: **iPad**

Sport to the Max (STTM) is a new magazine concept, delivered via an iPad app that aims to provide readers with interactive content that is both entertaining and informative. Targeted ostensibly at non-athletes seeking to improve their performance, the concept itself has a fresh feel to it, and tech-savvy readers should engage well with it. If the content in the prologue issue is representative of what is to follow in subsequent issues, then STTM seems to offer articles with a broad span of interest, from anatomy and physiology, to elite training programmes, technology, and kit reviews. STTM does have some significant 'cons' to go with the 'pros' though. The app itself has a habit of crashing, and articles are presented in such a way that means a reader finds themselves constantly turning their iPad from portrait to landscape, which is frustrating. Most importantly, though, is that the prologue is the only issue published since December 2012, leaving readers wondering if there is a future for STTM. Indeed, their website offers no further information (www.sporttothemax.com). If more issues are on the cards, then STTM could carve itself a market among those disillusioned with the supermarket shelf fitness magazines, but only if the quality of the prologue issue is maintained.

SCOTT EWAN, UNIVERSITY OF GREENWICH

Rating 6/10



Twitter account: @YLMSPortScience.
Sport scientist at the French Institute of Sport. Developing & Sharing scientific knowledge with coaches & athletes for sport performance.

Twitter gives sports scientists the ability to quickly read, discuss and share research. Summarising research in 140 characters or less is in itself a worthwhile endeavour, but it is the creativity of some going beyond these 140 characters that really catches the eye. Yann Le Meur, PhD, a sports scientist at the French Institute of Sport, is one scientist using Twitter to share sports science research with his 6,000+ followers. When scrolling down the feed, you find image after image (55 and counting) of colourful and eye-catching infographics on a wide range of sports science topics. If 140 character summaries are the 'Twitter abstract' then these infographics are the 'Twitter poster'. Recent topics have included recommendations for repeated sprint ability training, post-activation potentiation and alcohol's impact on performance. The infographics summarise research articles of note or include recommendations from Dr Le Meur himself. The graphics are easy to read and concisely present ideas and information about the topics. For Twitter users in any area of sports science, from bachelor's students to experienced researchers, following Dr Le Meur is highly recommended. For those without Twitter, the graphics can also be found on Dr Le Meur's blog - ylmsportscience.blogspot.fr.

CHRISTOPHER MCCRUM (@CHRISMCCRUM),
Maastricht University, The Netherlands

Rating 10/10



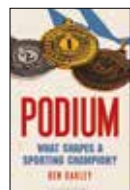
Project Rainbow - How British Cycling Reached the Top of the World
Ellingworth, R. & Fotheringham, W. (2014)
Faber & Faber

Hardback available for £15.19, Paperback available for £7.99 and Kindle version available for £4.79 from www.amazon.co.uk

Rod Ellingworth masterminded Mark Cavendish's 2011 win in the World Championship road race. It heralded the culmination of a vision set out by Peter Keen in 1997, which would see GB become one of the strongest cycling nations in the world. Ellingworth's 4 year plan ('project rainbow') was behind this success; a feat only achieved once before in 1965 by Tommy Simpson. This autobiographical story tells of Ellingworth's progression to the coach of the under 23 GB cycling team. He describes trying to find his feet as a coach, his attitude to the riders and his ideas towards coaching and training. His success is evident in the crop of riders who came through his U23 academy; namely Cavendish, Geraint Thomas, Matt Brammeier and Ed Clancy. Although he instilled rigid discipline, Ellingworth also formed strong bonds training the cyclists; picking them up after heavy crashes to take them to hospital and lifting morale when they broke down. As the story develops so does Ellingworth's role as he moved into a position in Team Sky Pro Cycling. He spares no truths describing his 24 hour role as a performance analyst and coach during Bradley Wiggins' 2012 Tour de France win. This book articulately describes what the life of a coach involves and how to help athletes achieve their potential. It's a fantastic resource for aspiring coaches from any sport or background.

DR OWEN JEFFRIES, ST MARY'S UNIVERSITY

Rating 6/10



Podium. What Shapes a Sporting Champion?
Oakley, B. (2014)
Bloomsbury

Paperback available for £10.39 and Kindle version available for £6.69 from www.amazon.co.uk.

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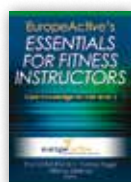
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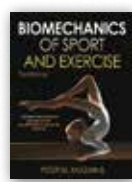


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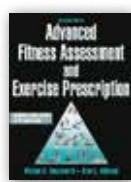
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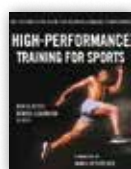


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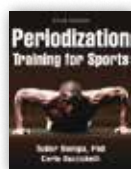
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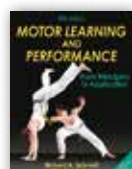
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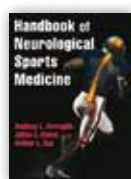
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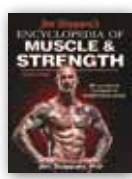
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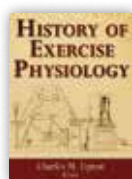
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Nick Matthew and David Pearson in the final keynote

What the delegates valued...

- The quality of the keynote speakers and the subject matter was excellent. The venue and the preparation by the BASES organisation committee made this year's conference a truly enjoyable experience
- Everyone in one place, booking including all meals and accommodation, compact nature of the programme, overall very well thought out.
- I met some interesting people
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3D laser scanning ancient bones: applying sports science to archaeology

Stacy Hackner describes her current research investigating the tibial diaphyseal mid-shaft shape among skeletal assemblages of ancient Nubians, who inhabited northern Sudan between 5,000 and 1,000 years ago.

Introduction

While most researchers in sports science investigate contemporary athletes, few realise that similar principles and techniques work equally well for ancient humans. The forces acting on bones in living humans have remained constant over millennia, allowing researchers to work backward and extrapolate types of activity practiced in ancient cultures and environments. Bone shape can be compared using a set of cross-sectional biomechanical properties that describe the strength of the bone in torsion and bending (Lieberman *et al.*, 2004). Finding these properties requires as accurate an image as possible of the external shape of the bone. Various methods to analyse bone shape have been utilised over the last three decades, including x-rays, computed tomography, plaster casting, and most recently, 3-dimensional laser scanning. The biomechanical geometric properties assessed through 3D scanning - total area, second moment of area, and polar moment of area - have been found to be highly correlated between methods with a low rate of error (Davies *et al.*, 2012). The benefit of 3D scanning is the subsequent ability of the researcher to perform digital morphometric analysis of horizontal slices of bone, which are then comparable to each other and to computed tomography (CT) scans of modern athletes, should they be available.

Why bone shape?

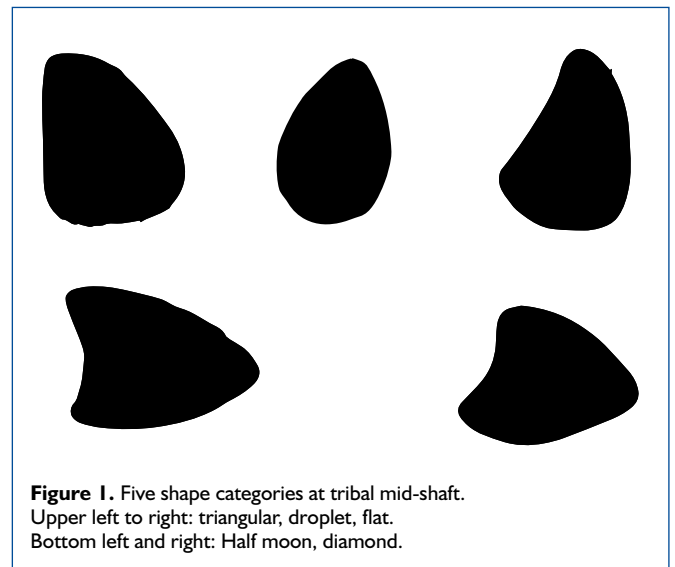
Studies of physical loading in modern populations test either the amount of force applied to or exerted by bone during a particular activity, or bone morphology in a particular population with shared activity. These studies have shown, with varying results, that bone grows in response to exercise; the commonly accepted principle is that intensity, duration, and frequency of activity all have an impact, particularly on healthy growing bone. This impact is often recorded as a change in bone mineral density. The time around puberty (thus, slightly younger in females than in males) seems to be key for activity-induced bone building. Hormonal changes affect bone growth, with estrogen (estradiol) increasing bone mass in females especially in combination with exercise - Devlin *et al.* (2010) found the year immediately following menarche to have peak bone growth. In males, increasing testosterone (and other androgens) promotes both bone and muscle growth, the rate of which can be accelerated with exercise (Lorentzon *et al.*, 2005; Ruff, 2003).

On the other end of life, changing crystalline structure and accumulation of microfractures lead to decreased bone mass and mineral content, which is accelerated in females by the reduction in estrogen levels at menopause. By age 90, a woman may have lost up to 50% of her peak bone mass and a man 10-25% of his (Kiebzak, 1991). However, the effect of the post-depositional environment and time makes archaeological bone samples unsuited for the kinds of testing used in these studies (Lovejoy *et al.*, 1976), as bone mineral seeps into the burial environment (or soil replaces bone), changing the density of archaeological bones. Fortunately, studies (Sparacello & Pearson, 2010, Stock & Shaw, 2007) indicate the diaphyseal bone shape achieved during puberty remains constant during life: most of the bone density lost is from the endosteal cavity rather than the periosteum, thus not affecting the results of external measurements for cross-sectional geometric properties or shape.

Researchers including Marchi (2008), Ruff and Hayes (1983), Ruff *et al.* (1984) and Wanner *et al.* (2007) recorded changes in long bone shape - including in the tibia - over various transitional periods, significantly during shifts from hunting to farming in various regions. In previous research, the author observed differences between male and female tibias in a Meroitic assemblage (*circa* 350 BC-550 AD) but not in a Kerma assemblage (*circa* 1750-1580 BC). Nikita *et al.* (2011) similarly explored differences in biomechanical properties between various North African assemblages, identifying that individuals from agricultural groups had lower tibial and femoral robusticity than individuals from possible pastoral (shepherding) groups.

Morphometric analysis

The current research investigates the site of Jebel Moya, about 250 km south of Khartoum. It was excavated between 1911-1914, revealing 3,135, of which a few hundred are curated at Cambridge's Duckworth Laboratory and 87 were examined here. New dating by Brass and Schwenniger (2014) has placed most of the burials between the 1st century BC to the mid-first millennium AD. The goal of 3D scanning the Jebel Moya tibias is primarily to discern their subsistence strategy - agricultural or pastoral - but it may also be able to distinguish social or sexual divisions of labour. Midshaft slices of the scans revealed five shape categories, identified by the author and verified through inter-observer testing.



Both males and females are represented in each shape, but the droplet category has a higher percentage female. Biomechanically, the droplet shape requires little muscle activity to form and is likely indicative of individuals with low levels of walking and running activity (Agur *et al.*, 2003). Additionally, those tibias with the droplet cross-sectional form tend to be shorter, with the lowest mean of all the shapes (396.23 mm): those who were not utilising the muscles involved in forward motion were also shorter individuals, which in this population tend to be female. The shapes with the lowest percentage of females - half moon,

diamond, and flat side - also tend to have the highest mean lengths (429.57 mm, 423.45 mm, and 421.09 mm respectively). These shapes represent the most deviation from the juvenile triangular tibial shape; the half moon is reflective of an activity utilising the *tibialis posterior* and *tibialis anterior* in combination with bending stress on the anterolateral edge, and the diamond is reflective of a walking or running activity utilising the *soleus*, *gastrocnemius*, and *flexor digitorum longus* muscles that build up a buttress seen on the posterior side (Gray, 1901; Ruff & Hayes, 1983). The diamond is the shape most similar to the CT scan of the tibia of a long-distance runner examined by Shaw and Stock (2009).

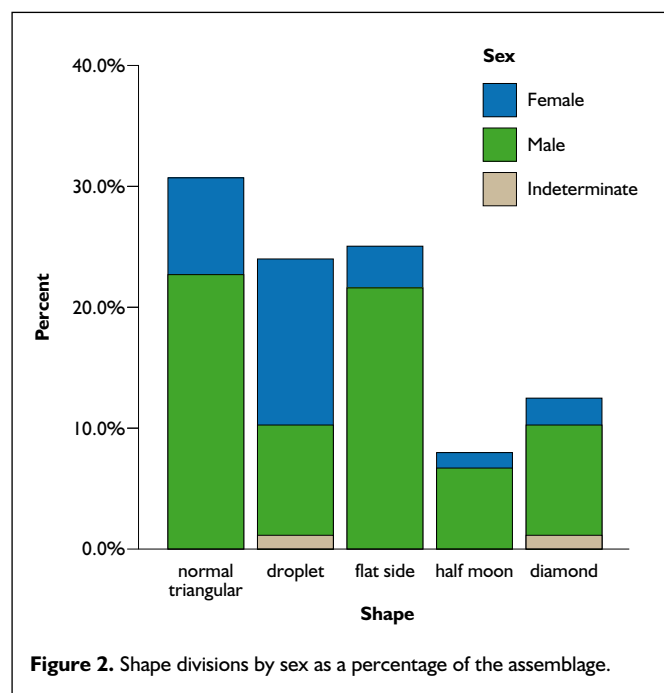


Figure 2. Shape divisions by sex as a percentage of the assemblage.

After rough shape analysis, the cross-sectional images were subjected to geometric morphometric analysis using Morphologika v2.5, where they were subjected to Procrustes analysis to normalise for size and angle and principal component analysis to determine the areas of greatest variance within the data. This resulted in 6 principal components. A one-way ANOVA was performed for the Principal Components to test significance of each. While Principal Components 1 and 2 account for more than 90% of the variance between tibias, the most significant ($p=0.009$) is actually Principal Component 5, which represents the depth of the lateral side of the tibia.

Further research

By equalising the size, shapes can be directly compared and biomechanical properties accurately measured. Shape is an important aspect of bone that has often been neglected. As varying shapes of bone may yield similar biomechanical geometric properties, shapes may be directly compared (as shown in the first method) with each other and also with studies of modern humans to aid in assessing the type of activity performed. The shape categories provide an insight into what type of activities various members of the assemblage performed during their adolescence and early adulthood. In Jebel Moya, the females appear to have performed less overall activity, and the activity they did involved more anteroposterior stress (a running or walking movement); the males performed a variety of activities, involving both anteroposterior and mediolateral stress. It is also possible to compare these tibial shapes with excavation records to determine if grave goods or burial position are associated with

a specific shape, indicating a craft or activity specialisation. Future research questions will also investigate substrate as a variable to see if walking on desert sand or agricultural soil results in differing tibial shapes as well as more comparisons with athletes. ■



Stacy Hackner

Stacy is a PhD candidate at University College London's Institute of Archaeology. She is working closely with the British Museum's Institute of Bioarchaeology and in conjunction with the Cambridge Duckworth Collection to study differences, particularly tibial shaft shape, in ancient human remains. Future plans include comparing archaeological data to that of athletes to establish how ancient versus modern activity affects tibial shape and strength.

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Global positioning systems (GPS) and training load: a useful tool for the athlete monitoring conundrum?

In this article Dr James Malone and Prof Barry Drust discuss the use of GPS devices for monitoring training load in the applied team sports setting.

Introduction

The constant growth and financial importance of professional sport has led to increased demand for the latest methodologies that enhance athlete performance and minimise the risk of injury. In team sports, the monitoring and optimisation of training strategies is often crucial for achieving such objectives. Coaches and sports scientist will often monitor training practices under the overall title of 'training load (TL)', which can be sub-divided into either external or internal TL (Impellizzeri *et al.*, 2005). The external TL refers to the specific training prescribed, whilst internal TL refers to the individual physiological response to the external stressor (Booth & Thompson, 1991). Traditionally, practitioners used a combination of heart rate and subjective scales (e.g., rating of perceived exertion) to monitor TL. In the past decade, there has been a significant increase in the use of sports technology products to help provide a more complete picture of the overall TL. Global positioning systems (GPS) are now commonplace amongst elite sports teams across a multitude of sports, such as soccer, rugby, American football and Australian football. The commercially available devices provide location and time information using a space-based satellite navigation system. Recent advances in the technology have led to the inclusion of inertial sensors (including accelerometers, gyroscopes and magnetometers) that provide additional information relating to athlete micro-movements. This article focuses on how GPS devices are used to monitor TL in the applied setting and the type of information that is available for practitioners to utilise.

Types of data produced

Commercial GPS systems, such as the one illustrated in Figure 1, provide a vast array of parameters and data sets for the end-user. These parameters are generated from both the GPS-derived device components (usually operating at true sampling rates of between 5-10 Hz) and also the inertial sensors (operating at 100 Hz). Typical reported parameters include the distance covered in different velocity zones (both absolute and individualised), accelerations and decelerations, tackle efforts and overall workload calculations (e.g., PlayerLoad™, Boyd *et al.*, 2013). Some GPS systems have in excess of 100 different individual parameters that can be exported using the respective software package. In terms of monitoring a typical individual training session with around 20 players monitored, this would be equal to over 2,000 potential overall data points per session.

Clearly practitioners will not utilise every single parameter available, but a significant portion still adopt the 'more is better' approach to athlete monitoring. Those experienced with using GPS systems longitudinally will often whittle down the parameters available into their own key performance indicators (KPIs). These KPIs can vary across sports and practitioners preferences, but will usually consist of a combination of the before mentioned parameters. Sports scientists are often seeking the 'golden bullet' parameter that can successfully quantify TL using one value. This has recently led to the development of a new range of parameters, such as the quantification of metabolic power (Gaudio *et al.*, 2013). Whilst the desire to advance



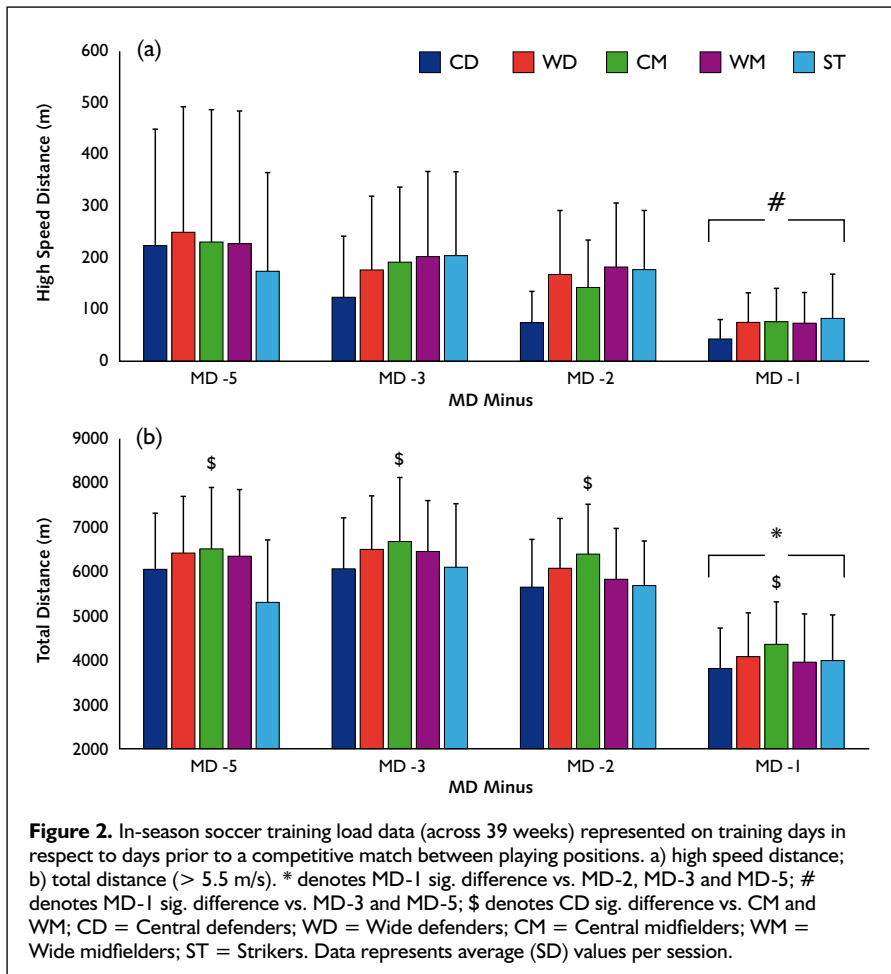
Figure 1. A commercial GPS system in action during a soccer training session.

our understanding of TL using GPS should be encouraged, it is also important that new parameters being produced are both adequately reliable and valid. This is crucial to determine whether the changes observed when monitoring training are actually meaningful from a practical perspective, in which the data 'signal' outweighs the 'noise' for the parameter used (Halson, in press).

How to use the data to monitor training load

There are numerous ways in which practitioners currently use GPS devices to monitor TL on a daily basis in the applied setting. Although the data produced is highly valuable, it should only act as a guide for sports scientists rather than using the data to exert complete control overtraining sessions. A large part of the process involved with any athlete monitoring system is the education aspect for both the coaches and the athletes. By presenting the data in a relevant and simplistic format, this will help future planning of training sessions, which may potentially lead to a more optimal TL being employed (Halson, in press).

In team sports in which there are a high frequency of competitive matches played throughout an annual season, the time available to train is often limited. As such, the emphasis of training sessions often switches from performance-enhancement to performance-maintenance during the in-season phase. A major task for sports scientists is to avoid overtraining in athletes that are already receiving a high load from the matches played. This is where GPS can be extremely useful, as practitioners can establish optimal threshold values for various parameters in reference to a particular training day. In the majority of team sports, microcycle planning is a crucial part of the overall periodization process. This is often broken down in respect to the number of days prior to the next match (i.e., match day minus [MD-]). By establishing upper and lower thresholds for each MD-, target values can be determined on an individual basis and used to prevent overtraining. Figure 2 displays GPS data from an elite English



Practical recommendations

- Ensure GPS monitoring strategy has **ease of use** and **simplistic reporting feedback system**
- Choose KPIs that **cover different components** of athlete performance
- Use parameters that have established **acceptable ranges of reliability and validity**
- Determine threshold values for athletes on an **individual basis**
- Real-time monitoring can **provide instantaneous feedback** to optimise training and rehabilitation
- Develop a **drill database** that can be used as a **guide for coaches** when planning training content.

Premier League soccer team in the MD- format across the in-season phase (Malone *et al.*, in press). We can see despite some differences between positions, the TL was only significantly reduced on MD-1 with TL remaining similar across MD-5 to MD-2. If such monotonous training is repeated longitudinally then this may increase the risk of staleness and increased injury risk (Foster, 1998). More elite teams are now beginning to employ the help of statistical experts to analyse their GPS data in order to find such patterns within their teams. This 'big data' approach is certainly the future of athlete monitoring, but caution must be taken when trying to apply the findings into an applied sporting context.

The use of GPS devices can also be of great benefit in the rehabilitation setting during the different stages of return to play strategies. GPS can provide detail relating to the overall loading involved with sport-specific actions (e.g., change of direction). By having data on an injured athlete when they were fully fit, physiotherapists and rehabilitation fitness coaches are able to identify target values to progressively increase the overall loading. An example may be during return to play following a hamstring injury, in which practitioners aim to limit the initial velocity in which the athlete runs in the early stages of return to play. By using the real-time GPS receiver, practitioners are able to receive live feedback on the athlete's velocity and thus feedback to the athlete in order to achieve the optimal values. The receiver can also be used in normal training sessions to provide feedback on an athlete's TL to limit over training or increase the TL if the load is insufficient. By monitoring sessions in real-time, drill data can be time stamped and subsequently downloaded to create a drill database specific to the sport. These databases can act as a manual for coaches, when selecting the appropriate drills in respect to the session's main targets. ■



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Critical issues for the development of reflective practice in the sport and exercise sciences

Dr Zoe Knowles FBASES, Dr Brendan Cropley FBASES, Emma Huntley and Dr Andy Miles FBASES discuss some contemporary reflective practice research.

Introduction

Within the domain of sport and exercise science, the last 15 years has seen a growing interest in reflective practice (RP) as an approach to experiential learning thought to help practitioners learn their craft, develop expertise, and become effective. This interest has predominantly stemmed from the disciplines of sport psychology and sports coaching. More recently, however, it appears that the potential efficacy of RP has been recognised in other disciplines within the sport and exercise sciences (see Handcock & Cassidy, 2014; Knowles *et al.*, 2014). This article will discuss some contemporary reflective practice research to highlight the key issues that we (as a sport and exercise community) currently face with integration of RP into our training curricula/practice. These factors have informed a new approach to the way in which BASES will educate and train neophytes and their supervisors.

Current state of reflective practice in sport and exercise

Although more than a decade has elapsed since the initial RP research in sport, the literature is still developing. In a recent systematic review, Huntley *et al.* (2014) found more than 170 articles in the domain of sport and exercise that had used the word 'reflection' (or connotations) in the title, abstract, and/or keywords. However, following further analysis, only 68 of these papers actually engaged with processes representative of RP. This 'misrepresentation' of RP appears to be one of the key factors hampering the wider acceptance of RP within the sport and exercise sciences. Confusion over definitions, practices, processes, and outcomes has influenced practitioners' experiences, often with consequences detrimental to the development of RP within the domain. Indeed, earlier research highlighted that a lack of understanding induced anxiety in practitioners who are asked to reflect and reduced the motivation to reflect-on-practice (Cropley *et al.*, 2012).

Second, there appears to be some concern over the nature of the evidence upon which claims about the value of RP are made. Huntley *et al.* (2014) noted that, in some articles, RP has been housed within auto-ethnographical narratives or within case studies of professional practice. Such research methods, however, are only considered valuable in the disciplines where RP has already become accepted. In a field that has traditionally judged research on its scientific rigour, the positivistic underpinnings of the sport and exercise sciences may have precluded the acceptance of RP as an appropriate pedagogy for experiential learning because of the constructivist and interpretivist nature of the evidence that we have. In line with this, Knowles *et al.* (2014) have recognised a continued necessity to balance scientific paradigms and the weight of evidence with personal reflective accounts of practice, which underpin different ways of knowing. Subsequently, Huntley *et al.* (2014) recommended the need for more evidence-based studies (e.g., interventions) to demonstrate the effectiveness and utility of RP, greater methodological attention and transparency within future research outputs.

A final issue concerns the way in which RP is utilised within Higher Education (HE) degree programmes, where it is often used as a formal part of module assessment. Here the chances are that students are more likely to reflect in a way that they think is expected and thus engage in normative behaviours linked to the assessment criteria. In a similar vein, the way in which RP is promoted through BASES Supervised Experience could be criticised for inducing sanitised reflective thought resulting in it becoming technical-rational in nature (e.g., reflection for reflection's sake to demonstrate the meeting of specific criteria). As a result, it is not likely that enduring reflective dispositions that influence critical explorations of self, practice, and context will be nurtured.

These issues may have emerged, in part, as a result of the sport and exercise sciences continually borrowing knowledge and practices from allied disciplines (e.g., nursing, education) that, whilst sharing similar characteristics as professions, are inherently different due to the contexts in which they operate. Both Knowles *et al.* (2014) and Huntley *et al.* (2014) have, therefore, called for discussion and evidence to emerge from the sport and exercise community to advance the understanding and practice of reflection with the domain.

Moving reflective practice forward in the sport and exercise sciences

In order to address the aforementioned issues we, as authors, believe that a number of considerations have to be made concerning: (a) the individual; (b) the domain; and (c) the culture of professional training and development.

1. HE degree programmes have to take responsibility for educating students about the nature of RP (e.g., what, why) as well as initiating their journey to develop the appropriate skills (e.g., problem solving, critical thinking) and attributes (e.g., open-mindedness, self-awareness) required for critical RP.
2. It should be the role of professional accreditation programmes to support and nurture the development of neophytes along this journey. As such, we have to ensure that trainees are afforded the necessary environment and support through which their reflective practices can flourish.
3. At a time when the external world is becoming more outcome and target focused, RP has to be placed at the centre of educational and professional processes. The tensions created between process versus outcome measures become overwhelming if there is no space for reflection.
4. A wider and more encompassing evidence base is needed that explores the development of context specific knowledge, understanding, and practice. In addition, a step-change in accepting different forms of evidence (and research) across the disciplines of the sport and exercise sciences is not only likely to improve the recognition of RP but also encourage practitioners to share reflective accounts of practice (cf., Morton, 2008).
5. Practitioners must recognise the need to learn from all aspects of their lives in order to develop an ecology of practice (an understanding of the 'whole self'). This holistic approach to learning and development starts to inform a 'living educational theory' that may better prepare us to be effective in practice.
6. Embracing new and innovative approaches to RP (e.g., through embracing technology) that emerge out of the nature of the discipline within which you are based will help to facilitate more lasting engagement. Through these approaches we need to ensure that experiences are transformed into learning, which is manifested through knowledge and/or action.

Reflective practice and the BASES Supervised Experience programme: Future directions

In light of the preceding discussion, it is the intention of the authors to reconstruct the core Supervised Experience workshop for RP. We aim to 'keep up with time' regarding the current needs for trainees progressing through Supervised Experience, who are increasingly exposed to the idea of RP during their undergraduate and postgraduate degrees, but who might still struggle with the concept of *what RP actually is* and *what it might look and feel like* (cf., Morton, 2008). Consequently, we propose the incorporation of an innovative pedagogy that draws upon principles of blended learning (e.g., online, interactive resources) and mentoring (e.g., feedback and discussion on reflections) in order to achieve the following workshop outcomes (delegates will be able to):

- Demonstrate an awareness and knowledge of the what, where, when, how, and why of RP
- Undertake RP using a variety of approaches and have received feedback on their reflections
- Be able to consider the most appropriate RP approach to suit their needs
- Select appropriate methods to evidence their reflections for the purpose of supervised experience and personal development.

Having had feedback from Dr Lisa Board (The Sport and Exercise Scientist, Spring, 2014) regarding the potential value in supervisors attending the workshop, it is also our intention to make the session available as an element of CPD to those engaged in the 'supervisor training' process as well as established supervisors. It would seem that such an endeavour could help to open and support discussion between supervisor and supervisee regarding RP, as well as helping the supervisor with strategies to facilitate their supervisee's RPs.

Final note

In developing the above we make a call for new Supervised Experience registrants and supervisors to engage with us on our research. A supervisors' survey can be accessed at http://surveys.edgehill.ac.uk/bases_reflective_practice. Supervised Experience candidates will be invited to participate through the Supervised Experience induction process. ■



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Ask what your Association can do for you, but don't forget to ask what you can do for your Association

Dr Keith Tolfrey FBASES reflects on his 22 years of membership of BASES.

Thanks to the generous £500 BASES International Conference grant, I attended the biennial North American Society for Pediatric Medicine (NASPEM) conference at the University of Minnesota. Alice Thackray, one of my PhD students, also attended the meeting, where back-to-back oral presentations allowed us to tell a knowledgeable, experienced, international audience about our recent work. NASPEM has no parallel sessions and is only attended by those interested in and conducting research with young people (infants, children and adolescents). This means you get a good sized audience, at least 90 to 100 in our session, and people who are genuinely interested in your work. This research examined the effect of dietary and exercise energy expenditure manipulations on postprandial plasma fat and glucose metabolism in adolescent boys and girls - please contact me if you would like a copy of the presentations, abstracts or further details.

When I was invited to write an article for *The Sport and Exercise Scientist*, my contribution for accepting the Association's generous support, I was encouraged to avoid a bland description of the conference and championing my own research. This advice is completely understandable given the diverse readership of this publication and considering the readers' extensive, collective conference experience; hence, only a brief acknowledgement to the conference above. However, I don't know about you, but having a blank canvas at my disposal, has caused some headaches recently. After 22 years of continuous BASES membership, you'd think there was plenty to write about! The title is, as it should be, a bit of a give-away, but before I begin, you should know that no-one from within BASES has asked me specifically to write this - it is not a subliminal message from the Board. It is my personal philosophy

on team, group, society, any collective...membership.

In addition to my BASES membership, I am a professional member of the European College of Sport Science (ECSS), American College of Sports Medicine (ACSM) and North American Society for Pediatric Exercise Medicine (NASPEM) (where I sit on the Board). To be frank, this does not come cheap and I cannot claim membership from my work budgets or any grants I have. However, membership in all of these groups allows me to attend their conferences at reduced rates (refer to Professor Craig Williams' article in the Autumn 2014 issue of *The Sport and Exercise Scientist* for the benefits of conference networking); in fact, some discounted membership and conference attendance packages are cheaper than the cost of attendance alone. I joined BASS (BASES' predecessor) in 1992 so that I could present my MPhil research as a professional member and attend at the reduced rate - the conference experience in Edinburgh was so inspiring that I renewed my membership the following year. However, I cannot claim to have attended all of the Annual Conferences since 1992, so what else has driven me to retain my membership for 22 years?

Before we join an organisation, we normally weigh the (material) benefits against the cost - thus, assessing the perceived worth or value of membership; this reminds me of a scene in *Monty Python's Life of Brian* where Reg (John Cleese) asks "and what have they ever given us [in return]?" www.youtube.com/watch?v=ExWfh6sGyso. A comprehensive list of BASES membership benefits are listed on the website and are similar to the other organisations where I'm also a member. In these austere times, these benefits can be the primary driver when deciding whether to part with your hard-earned money in stumping-up the annual fee. These member

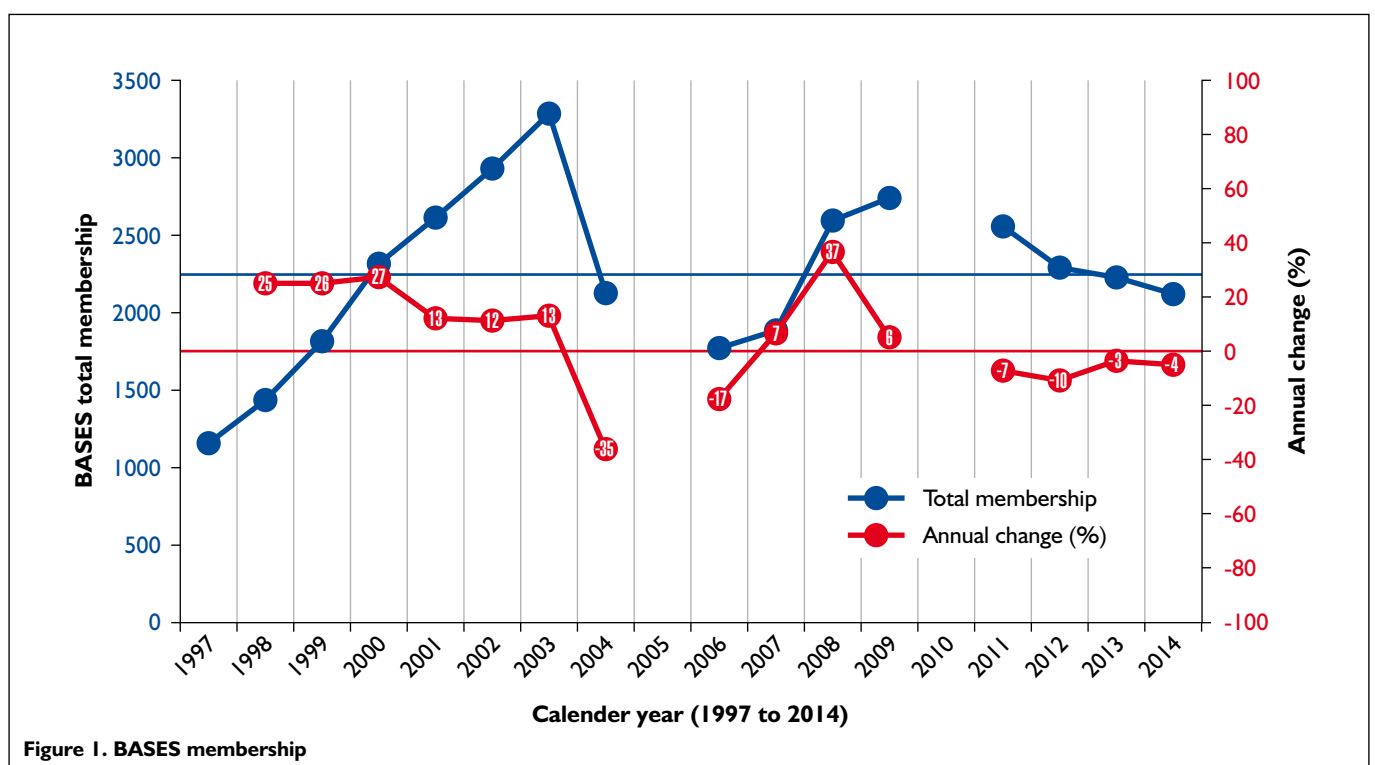


Figure 1. BASES membership

benefits certainly contribute to my decision to renew each year, but early in my career an esteemed senior colleague and mentor suggested that membership also demonstrates a commitment to the profession (to the team); it is an overt display that you want to contribute to the on-going advancement of, in this case, British Sport and Exercise Sciences. In short, membership has provided me an opportunity to give something back to balance what I have taken. For me, this is still the main reason to continue my long-standing relationship with BASES (and other organisations).

To be fair, it isn't entirely altruistic, my contributions to these organisations are listed on my CV and have probably played some part in my career progression. So why have I decided to write about this rather than taking this opportunity to encourage more of you to direct your research to generating research questions that examine young people's health, physical activity, exercise, sports participation and performance? Well, this article provides a platform for me to ask two questions that I think are critical to the long-term standing of BASES as the 'go to' British organisation in the sport and exercise sciences:

1. Do we need to increase the BASES membership to have a greater impact on prominent sport and exercise issues?
2. Are the BASES membership largely active or passive?

Using the archive of BASES Annual Reports www.bases.org.uk/Publications-Documents-and-Policies, I managed to track the annual total membership data from 1997 to 2014 (see Figure 1). The red line represents complete stability in membership from one year to the next (0% change), whereas the blue line is the average membership over this 18 year period (2,249 ± 550); it was not possible to locate membership data for 2005 or 2010. It is important to recognise that any changes in total membership reflect both out-going and in-coming members, and the various membership categories. For a number of years, the students were the majority, although the proportion of professionals match the students currently - the precise breakdown is not always apparent from the annual reports. Following six successive years of growth up to 2003, when membership peaked at 3,300, attrition exceeded enrolment resulting in a 46% reduction over the next three years. Recognising the down-turn in membership, the BASES Board initiated a Membership Working Party in 2003/4 and then formulated a Strategy for membership recruitment and retention in late 2006. Three successive annual increases (54%) in membership suggest these initiatives were effective - they included:

- A focus on making the membership package more attractive
- Creation of network representative contacts (an academic plus student) in higher education (HE) sport and exercise science departments
- Targeting HE students and academic staff to make use of existing resources and capabilities - the perception was this market had not reached saturation
- Addition of graduate student and retired academic membership categories and a reduction in student fees
- Survey of membership (~9% completion rate) to identify areas of strength and sought after member benefits
- Introduction of more eye-catching recruitment posters and application forms.

From this brief appraisal of the available membership data and accompanying information from the Annual Reports, two points seem apparent, (1) there has been a marked concentration on higher education academia and, (2) acknowledgement that tangible membership benefits are vital to attract and retain members. It is

also quite clear that a concerted effort to satisfy the membership has always been a key objective for BASES over the years. This takes me back to my first question posed above; if we do need to expand the membership, then the data suggest a well-laid action plan is required to achieve this goal. However, it also raises questions about our target audience. Is our focus on academia too narrow, potentially to the detriment of BASES' wider impact and is it constraining our numbers because only a small minority of the thousands of sport and exercise science graduates stay in HE?

Whilst you ponder these questions, I'll finish by touching on the issue of BASES member activity, within or for the Association that is. Beware, this bit may stir some strong emotions or reactions! There is little doubt that everyone is extremely busy with not only sport and exercise science-related work, but also other lifestyle activities (e.g., personal hobbies, raising a family, etc...). Consequently, anything extra can be draining if we're not careful.

“In short, membership has provided me an opportunity to give something back to balance what I have taken. For me, this is still main reason to continue my long-standing relationship with BASES.”

However, is BASES getting the most from its multi-talented membership? In reading (scanning) 18 consecutive Annual Reports, several familiar names cropped up, some with great regularity, and many are highly prominent figures in sport and exercise science. I'm avoiding naming individuals as it is unfair to pick-out anyone for making a greater or lesser contribution. This year's Annual Report, suggests that there are 65 to 70 formal positions within BASES (excluding *Journal of Sports Sciences* editorial roles) and there are 11 special interest groups with varying degrees of involvement. These are more overt markers of BASES activity, but engagement can be measured in many other ways; for example, writing for *The Sport and Exercise Scientist*, reviewing books or mobile apps, using the BASES Facebook and Twitter media, attending and presenting at the Student and/or Annual Conferences, contributing to BASES position stands, writing BASES expert statements, leading or participating in webinars or giving your affiliation as a BASES member when working with the media. My gut feeling (not the best scientific evidence gathering technique) is that the majority of members are relatively passive within the Association (i.e., they limit their involvement to simply enjoying their member benefits). Before you pen the hate mail and ask who I am to 'judge', this isn't meant as a slur on any BASES member - I'm proud to stand alongside anyone who's in this 'team'. I am, however, questioning whether a more active membership could enhance what BASES stands for and the impact it could have. Perhaps, greater engagement could even offset the potential need for more members?

I finish where I began: **Ask what your Association can do for you, but don't forget to ask what you can do for your Association. ■**



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Critical timing in pre-performance routine of self-paced closed skills

Vicki Aitken examines the use of pre-performance routines in sport by comparing the empirical evidence of their effectiveness with her experiences as an applied consultant.

What is a pre-performance routine?

A pre-performance routine refers to the behaviours, actions and thoughts leading up to specific performance point in the execution of a motor skill (e.g., kick, hit or release). Pre-performance routines have been identified in the literature as being crucial for peak performance in self-paced events with target aiming tasks like golf shots, goal kicking in rugby, penalty kicks in soccer, serving in tennis, free throws in basketball and the release of a dart or arrow in archery (e.g., Singer, 2002; Crews & Boutcher, 1986; Jackson & Baker, 2001). They serve to ready an athlete both mentally and physically to perform at his/her very best. The routine is posited to help block out distractions. Specifically, in closed skilled tasks it helps athletes to physically set up and align themselves, to be focused on their target, to be decisive and trust their ability, and finally it should suit their personality (or individual differences) (Rotella & Cullen, 1995). Good pre-performance routines, where each thought and action has a useful purpose, helps athletes to become more consistent in their performance.

Research discrepancy

Cotterill (2008) eloquently points out in his review of pre-performance routine literature that there is a discrepancy between those studies that advocate the exact timing and repetition of behaviours in a pre-performance routine as being critical to success (e.g., Douglas & Fox, 2002). For example, Jackson and Baker's (2001) study of rugby kickers demonstrated

that with increased task difficulty, rugby kickers perform the same pre-performance routine but in a slower fashion when compared with easier goal kicks.

In comparison Douglas and Fox (2002) supported Boutcher's (1990) recommendation that all pre-performance routines should have the same behaviours and be the same length in time from the beginning of the routine to the end. This is something that most coaches and practitioners have supported over the years.

In his attempt to reconcile these differences, Cotterill (2008) points out that Jackson and Baker's study (2001) has more ecological validity, having been conducted in the field than those undertaken by Douglas and Fox (2002) or their predecessors (e.g., Crews & Boutcher, 1986). Therefore, Cotterill suggests that athletes might be better off employing the variation in routine on time (but not behaviour) to suit different situations and levels of difficulty. After all, golfers have different routines for different shots (e.g., putting versus long game shots).

Alternative reconciliation: critical timing points

As a BASES accredited sport and exercise scientist, I have observed the use and consequent effect of pre-performance routines in action. In my experience, I believe that for pre-performance routines to be effective, the answer lies somewhere in between these two sides of the argument. The critical timing of the routine must be the same in order to create the reaction of open skilled

Left: Percy Montgomery of South Africa, prepares to kick the ball, during the match Fiji vs South Africa, of the Rugby World Cup France 2007, in Marseille
 Courtesy Paolo Bona/Shutterstock.com. Copyright: Paolo Bona

sports and the desired automatic performance of the relevant skill.

In my experience of working with golfers, I have observed the detrimental effect of a poorly timed pre-performance routine on the resultant shot. Furthermore, a visual examination of goal kicks taken by international rugby union players in televised games reveals a similar pattern. For example, I have selected Athlete X's (an international-level goal kicker) kicking performance in the last two games he featured in during the 2011 Rugby Union World Cup. In Table 1, you can see the outcome of the kick alongside the timing of his associated pre-performance routine (from last look to kick).

Table 1. Athlete X's 2011 rugby world cup goal kick timings

Kick 1	6 seconds	Successful
Kick 2	3 seconds	Misses (too quick)
Kick 3	7 seconds	Misses (too long)
Kick 4	6 seconds	Successful

I recorded similar information for Athlete X's replacement, Athlete Y, who appeared more consistent with his kicking. His pre-performance routine timing was consistent but the cause of his third kick's miss occurred when he started to talk out loud to himself (see Table 2).

Table 2. Athlete Y's 2011 rugby world cup goal kick timings

Kick 1	5 seconds	Successful
Kick 2	5 seconds	Successful
Kick 3	5 seconds	Misses *overt self-talk*
Kick 4	5 seconds	Successful

In my observations and experiences, I have found that athletes take more time to conduct their pre-performance routines for longer or more difficult kicks, shots or targets. During the longer execution of the routine, athletes are imaging the resulting flight of the ball, dart or arrow. E.g., it often takes golfers longer to execute their pre-performance routine when they image the full length of a 20 foot putt than if they are preparing to take a 3 foot putt. However, I believe the critical timing point will need to be the same regardless of the length or difficulty of the task. Although this will differ from person to person. For example, Athlete X is more successful with 6 seconds and Athlete Y is more successful with 5 seconds from last look to kick.

Targets and consistency of time and thought

A good pre-performance routine will allow the athlete to focus externally (e.g., on the intended target). By encouraging the athlete to look at the intended target before (and during in the case of darts or archery) actioning the task helps the athlete to keep an external focus throughout (even if it is a covert glance as in a tennis serve so as to not let your opponent predict the target of your shot).

Athletes that take longer during their critical timing point (i.e., last look at the target and the hit or kick) than usual have reported to me over the years that they have had an extra thought and usually a negative thought or a doubt. E.g., a golfer might think "I'm not sure this is the right club - oh well I'll hit it anyway"...and then they miss. Those athletes that take less time with their routines, tend to report having either rushed themselves or that they were having a 'blank moment'. Simplifying the thought process and minimising the time between the last look and execution means athletes are more likely to execute their skill successfully.

Training the timing

It is possible to train the critical timing of a pre-performance routine. I'd recommend firstly checking that all the behaviour and thinking in the pre-performance routine serves a purpose. Then ensure that the thinking and behaviour are very simple and minimal between the last look (first look in the case of darts or archery) at the target and the execution.

In golf I have come up with something call the 'React and Go' Drill ©2005, which is based on the idea of a smooth transition of a baton in a relay race, there is no stopping or pause. In this way the golfer takes their last look at the target and as their head and eyes come back to the ball, the club head starts going back in the same smooth movement all with the same timing. This helps train the critical timing point and improves rhythm and increases consistency of ball strike. It also means there is no time for additional thoughts to creep in which at this point are usually negative and potentially detrimental. With other sports merely practicing the routine and keeping the timing consistent during this critical point will help the athlete to develop the consistency needed.

So what?

My observations and experience working with many athletes over the years have suggested that the answer to the conflicting research lies in the critical timing points of the task being executed. Research needs to be carried out to test the observations reported and the associated theory to help extend and deepen our understanding of how a pre-performance routine can enhance performance, especially those that involve a closed skill component. As a result coaches, mental skills coaches and sport psychologists will be better able to guide their athletes to peak performance. ■



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Final Word with Prof Don MacLaren FBASES

One journal article or book that I think all sport and exercise scientists should read

Sport and exercise science has come a long way in a relatively short time. When I transferred (so to speak) from a lecturer in biology to one in exercise physiology in 1980 the sport sciences were in their infancy in the UK, although some significant work had been ongoing for some time elsewhere. I was amazed at the breadth of research in the subject when I read Paul Milvy's (Editor) tome *Marathon: Physiological, Medical, Epidemiological, and Psychological Studies*. Although published in 1977, the chapters from eminent early researchers were presentations made at a meeting in 1974. Students should read some of the relevant chapters and then appreciate how far we have come in 40 years.

One moment that changed the course of my career

As a young lecturer in biology at Christ's College (Liverpool), but with a passion for sport, I was asked to lecture to 3rd and 4th year BEd Physical Education students on sports science/physiology in 1978. With some misgivings I gave it a go - mugging up with Astrand & Rodahl's *Textbook of Work Physiology*. And the rest, as they say, is history! I became so keen in this new subject area that when an opportunity came to take up a position at Liverpool Polytechnic in 1980, I did so with trepidation but relish.

One challenge that I think sport and exercise science faces

It is the perennial one of sport science being perceived as PE. No wonder some 'uneducated' scientists view us with an element of disdain. Perhaps it is one reason why we have difficulty in getting research grants.

One thing that I would change about sport and exercise scientists

When I first came into the sport sciences, the student cohorts were invariably well grounded in the so-called hard sciences. Over the years that has changed, and indeed over more recent times, so has the time (lecture, practical, and tutorial) devoted to student contact. I would welcome the chance to provide more personal student contact in the laboratory and in tutorials, thereby enriching student (and staff) experience. I am a traditionalist after all!

One hero from past who has influenced me

Prof Tom Reilly - my mentor, PhD supervisor, colleague, and friend. Tom is sadly missed.

One thing that I think makes a great conference

Great organisation, with excellent keynote speakers for stimulation.

One proud moment

Attaining my PhD. I had not aspired to this at university, but once I engaged in sport science lecturing it was a must.

One embarrassing moment

Once these new-fangled computers came in with their spell checks etc (remember I grew up with 'chalk and talk', overhead projectors, and typewriters!!!), I remember sending out e-mails signed Don Macaroon. How was I to know (and I didn't check) that these computers would change my typing to a word in the dictionary. MacLaren didn't exist but Macaroon did.



One bit of advice that really influenced me

"Evil flourishes when the good do nothing." I have taken this to mean a number of things throughout my life - and sometimes it has got me into hot water because I have to speak out if I feel an injustice has been done. This does NOT mean you must hurt someone's feelings and belittle them (as can happen at conferences) but it does NOT mean you should keep quiet when something is wrong - because that implies you agree with what is being said or performed.

One piece of advice for up and coming sport and exercise scientists

Make sure you focus on your chosen subject area as soon as you can. Success (nowadays) is determined by specialism not generalism.

One regret

Never achieving the grades to study medicine. I am a frustrated medic.

One thing that really irritated me at work

Having retired in 2010, I would have to say that I have NO regrets in the mass marking of assignments in a short turnaround time. Marking assignments carefully takes time and dedication, and should not be rushed. The problem is 'mass education' - students are people and not commodities. Now that will not make me popular.

One person I would like to have dinner with

Richard Dawkins. As a committed and practising catholic (yet a scientist who has taught evolution), I would like to debate how I believe science is compatible with there being a God. ■

Prof Don MacLaren FBASES

Don is a professor emeritus of sports nutrition, which is a testimony to his many publications on the subject in journals and books as well as his presentations at scientific and coaching conferences. He has been and still is nutritional consultant with a number of high level football and rugby clubs.

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