

The Sport and Exercise Scientist

The official publication of the British Association of Sport and Exercise Sciences

Issue 47, Spring 2016

‘Baseline to start line’ Physical preparation through the Rio Olympiad

Alex Wolf and Dr Emma Ross FBASES

ISSN 1754-3452

BASES Conference 2016 • East Midlands Conference Centre • 29-30 November
www.basesconference.co.uk

Turning the corner on the correct use of terms and nomenclature to describe performance in sport and exercise?

Emeritus Prof Edward M Winter FBASES and Prof Duane V Knudson advise on the accurate use of scientific terms.

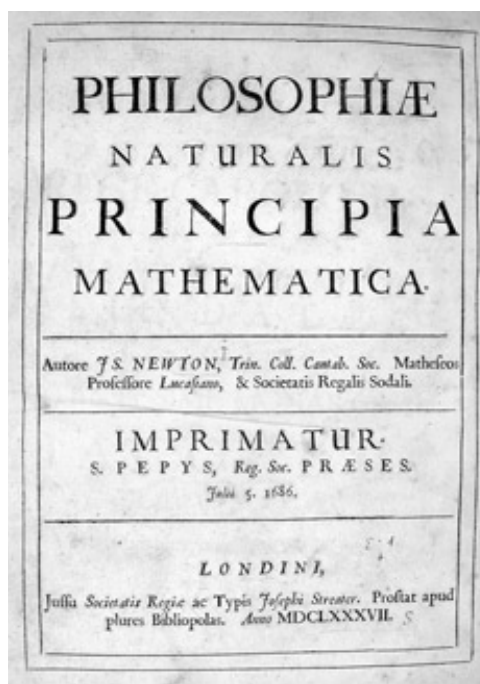
Introduction

Some 35 years ago, a PhD supervisor alerted one of the authors (Emeritus Prof Edward M Winter FBASES) to the misapplications of classical (Newtonian) mechanics in descriptions of the performance of exercise. That introduction sparked an interest that we share and that has seen expression of a gamut of emotions. From fascination, enjoyment and delight at sport and exercise science research reports through to frustration, exasperation, and almost despair at the unwillingness or inability of colleagues to use what is clearly laid down by Newton in his 1687 *Philosophiæ Naturalis Principia Mathematica*, the *Système International d'Unités*, the Royal Society (1975) and hence, science. This column is a reminder that science requires clear communication and accurate use of scientific terms if knowledge is to advance. It also provides some background to the recent paper on this topic entitled *Misuse of 'power' and other mechanical terms in sport and exercise science research in the Journal of Strength and Conditioning Research* (Winter et al., 2016).

The unfortunate tradition of turgid and florid text

To begin with, note our use of 'terms' in the title. This contrasts with those who use 'terminology' and for that matter, its compatriot 'methodology'. The suffix 'ology' indicates 'the study of' when what is usually meant is simply a description of 'terms' and 'methods'. Yet, writers often have a misguided belief that they must use arcane 'academic' language. Instead, they present a tyranny of tortured prose. This poor communication is exacerbated when long, difficult sentences are punctuated with secret terms with vague meanings that contradict their true scientific definition.

One of the most common examples of sport and exercise term abuse is the use of 'contraction' to describe the activation and tensile forces of skeletal muscles that contribute to some intentional action. In the elegant experiment that he conducted some 400 years ago, Swammerdam clearly demonstrated that when stimulated to exert force, muscle does not reduce in volume, i.e. it does not contract. Skeletal muscle creates active and passive tension that is transmitted to both attachments to interact with other forces and so influence musculoskeletal motion and posture. Yet, in spite of the key demonstration to the contrary and against the recommendation of Rodgers and Cavanagh (1984) in their respected glossary, 'concentric', 'eccentric' and 'isometric' are still frequently used as adjectives to the misnomer 'contraction'. Subsequent papers advocating the use of 'muscle action' (Cavanagh, 1988) have not prevented the misleading tradition of referring to muscle contraction. This weak



use of terms generally internal to the field, however, is probably less damaging than incorrect use of standard scientific terms.

Abuse of scientific terms

Misapplication of scientific, especially mechanical variables and terms, is at epidemic proportions in many sport and exercise science research reports. In particular, five key terms tend to be most abused: 'energy', 'force', 'work', 'power' and 'efficiency'. These terms have strict definitions in classical mechanics. Moreover, the definitions are both clear and simple, and have standard units. Nevertheless, authors subscribe to what can best be described as the discipline of whackychanics as they use idiosyncratic and incorrect interpretations of clearly defined, standard scientific terms. Astonishingly, even journals that have science in their title contribute to the error by allowing body weight - a

force - to be expressed in the unit of mass (i.e. kg). Just what are those with editorial responsibilities doing if they allow such a transgression? How can they argue for equal funding and respect with the natural sciences if they ignore the principles of science? In short, editors and reviewers of most exercise and sport science journals diminish the advancement the field because when they are insensitive to the repeated calls for correction of these errors in the peer-review process.

“For at least 115 years, formal concern has been expressed about misuse of terms in scientific research reports.”

For at least 115 years, formal concern has been expressed about misuse of terms in scientific research reports. The first such expression we know of is the splendid article by the wonderfully named physicist Daniel Webster Hering. Published in *Science* in 1900 it was entitled *The misuse of technical terms*. Hering highlighted the misuse of scientific terms by authors who should know better, and specifically noted abuse in the context of exercise research as examples. Unfortunately, the field of sport and exercise science has continued incorrect use of scientific terms. This has resulted in numerous follow-up papers that reinforce Hering's cogent warnings. In 1978, when he was Editor-in-Chief of the current journal *Medicine and Science in Sports and Exercise*, Professor Howard Knuttgen wrote a directive on correct use of scientific terms to describe exercise performance by which authors were meant to abide if their manuscripts were to be published in the journal. A decade later, Knuttgen and Kramer (1987) kicked off another journal with the same message

about expectations for accurate use of exercise terms. Lamentably, these directives have been and continue to be largely ignored. We know because for several years, Emeritus Prof Edward M Winter FBASES has done audits of these journals' reports.

Many other journals continue to have this problem. This has prompted additional attempts to stem scientific communication malpractice. In 2009, papers in the *Journal of Sports Sciences* (Winter & Fowler, 2009) and the *Journal of Strength and Conditioning Research* (Knudson, 2009a) independently attempted to confront this malpractice and improve the accuracy of research reports and scientific progress in sport and exercise science. The latest manuscript, *Misuse of 'power' and other mechanical terms*, is yet another attempt to stem the malpractice and confused communication (Winter *et al.*, 2016). The continued misuse of mechanical terms in the literature led an international, multi-author group to recommend action among the editors and scholars in sport and exercise science. The group comprises current or past editors-in-chief of leading journals. They span disciplines that include biomechanics, medicine, physiology and psychology. All of the authors share a common concern: dismay at poor use of terms and nomenclature. Similarly, all have a common aim: to uphold principles and practices of science.

“Highlighting malpractice of your peers is not the best way to increase the number of Christmas cards one might receive. However, if sport and exercise science is to advance, abuse of terms must be highlighted and confronted.”

The rocky road to improvement

Highlighting malpractice of your peers is not the best way to increase the number of Christmas cards one might receive. However, if sport and exercise science is to advance, abuse of terms must be highlighted and confronted. The path to improving accurate use of mechanical terms is difficult. First, the numerous papers noted above have been ignored for decades. It is also not uncommon in sport and exercise science and other scientific fields to be resistant to recommendations to improve peer-review (Knudson *et al.*, 2014), sample sizes (Knudson, 2011; Knudson & Lindsey, 2014; Marszalek *et al.*, 2011; Maxwell, 2004), statistical analyses (Hopkins *et al.*, 2009; Knudson, 2009b; Morrow & Frankiewicz, 1979; Mullineaux *et al.*, 2001), and interpretation of evidence (Knudson *et al.*, 2014) in research reports.

The correct use of scientific, particularly mechanical terms, applies to all aspects (i.e. teaching, research and consultancy) of advancing sport and exercise science. Only through the collective efforts of all scholars to hold each other accountable to the principles of clear scientific terms, design, analysis and data interpretation, will the field of sport and exercise science advance. We owe this to our natural and behaviour science colleagues, as well as the public we serve. Perhaps the latest manuscript and those that have gone before will be adopted more widely. According to Research Gate, in the short period since its appearance the Winter *et al.* (2016) publication has had some 2,000 reads. We can but hope that this is not symptomatic of the infatuation with incorrect use of the term 'power' (Knudson, 2009a; Winter *et al.*, 2016), but evidence that colleagues will join us in these efforts to advance the field. Will you? ■



Emeritus Professor Edward Winter FBASES

Edward is a BASES accredited sport and exercise scientist, a Chartered Scientist and a Doctor of Science.



Prof Duane Knudson FACSM, FISBS, RFSA

Duane is a biomechanist and department chair at Texas State University.

References:

- Cavanagh, P.R. (1988).** On "muscle action" vs "muscle contraction." *Journal of Biomechanics*, 21, 69.
- Hering, D.W. (1900).** The misuse of technical terms. *Science*, 11, 1028-1030.
- Hopkins, W.G. et al. (2009).** Progressive Statistics for studies in sports medicine and exercise science. *Medicine and Science in Sports and Exercise*, 41, 3-13.
- Knudson, D. (2009a).** Correcting the use of the term "power" in the strength and conditioning literature. *Journal of Strength and Conditioning Research*, 23, 1902-1908.
- Knudson, D. (2009b).** Significant and meaningful effects in sports biomechanics research. *Sports Biomechanics*, 8, 97-105.
- Knudson, D. (2011).** Authorship and sampling practice in selected biomechanics and sports science journals. *Perceptual and Motor Skills*, 112, 838-844.
- Knudson, D., Elliott, B. & Hamill, J. (2014).** Proposing application of results in sport and exercise research reports. *Sports Biomechanics*, 13, 195-203.
- Knudson, D. & Lindsey, C. (2014).** Type I and type II errors in correlations of various sample sizes. *Comprehensive Psychology*, 3, 1. doi:10.2466/03.CP3.1
- Knudson, D., Morrow, J. & Thomas, J. (2014).** Advancing kinesiology through improved peer review. *Research Quarterly for Exercise and Sport*, 85, 127-135.
- Knuttgen, H.G. (1978).** Force, work, power and exercise. *Medicine and Science in Sports*, 10, 227-228.
- Knuttgen, H.G. & Kraemer, W.J. (1987).** Terminology and measurement in exercise performance. *Journal of Applied Sport Science Research*, 1, 1-10.
- Marszalek, J.M., et al. (2011).** Sample size in psychological research over the past 30 years. *Perceptual and Motor Skills*, 112, 331-348.
- Maxwell, S.E. (2004).** The persistence of underpowered studies in psychological research: causes, consequences, and remedies. *Psychological Methods*, 9, 147-163.
- Morrow, J.R. & Frankiewicz, R.G. (1979).** Strategies for the analysis of repeated and multiple measures designs. *Research Quarterly*, 50, 297-305.
- Mullineaux, D.R., Bartlett, R.M. & Bennett, S. (2001).** Research design and statistics in biomechanics and motor control. *Journal of Sports Sciences*, 19, 739-760.
- Rodgers, M.M. & Cavanagh, P.R. (1984).** Glossary of biomechanical terms, concepts and units. *Physical Therapy*, 12, 1886-1902.
- Royal Society (1975).** Quantities, units and symbols. London: Royal Society.
- Winter, E.M. & Fowler, A. (2009).** Exercise defined and quantified according to the *Système International d'Unités*. *Journal of Sports Sciences*, 27, 447-460.
- Winter, E.M. et al. (2016).** Misuse of "power" and other mechanical terms in sport and exercise science research. *Journal of Strength and Conditioning Research*, 30, 292-300.