

***Ergonomics* at 60: mature, thriving and still leading the way**

Editorial, Volume 60, Issue 1

It is in our nature to mark anniversaries, with anniversaries containing zeros singled out for particular celebration. First appearing in 1957, the arrival of 2017 sees *Ergonomics* enter its 60th year of publication, a milestone for the discipline. *Ergonomics* was the first major journal in the field, followed shortly in 1958 by *Human Factors*, the journal of the USA Human Factors and Ergonomics Society. *Applied Ergonomics* entered publication in 1970, with the much younger sibling *International Journal of Industrial Ergonomics* entering the scene almost 30 years later in 1986. Other ergonomics journals now exist, but these four are the most influential, as listed by the Journal Citation Reports 'Ergonomics' category.

The opening lines of the first paper, in the first issue of *Ergonomics* in 1957, addressing human limitations and vehicle design, ran as follows:

“An important factor influencing efficiency in the operation of vehicles is the extent to which the automotive equipment has been designed to meet human capabilities and limitations. If instruments and controls are considered as extensions of the driver's sense organs, nervous system and body appendages, it is reasonable to expect that machines should be designed from the man outward. Mechanical design should be intimately related to the biological and psychological characteristics of the driver. If this point of view - usually referred to as human engineering, biotechnology, or engineering psychology – is carried out in practice, greater operational efficiency and fewer errors should result. Also, extensive redesigning of equipment after it is put into use should be eliminated.” (McFarland, 1957).

The research journey in the area of driving and vehicle ergonomics, as embarked upon by McFarland, continues to be one of the more active areas of ergonomics research today. Other papers in the first issue examined the effects of noise on behaviour (Broadbent, 1957); reducing physical demands on foundry workers (Scholz, 1957); results of different methods of worker training (Belbin et al, 1957); effects of increased skill on task cycle time (De Jong, 1957); experience of flicker sensation with lighting (Collins and Hopkinson, 1957); train driver fatigue and stress with only one driver present (Schwab, 1957) and last, but not means least, “determining the preference of users for new technical devices ... in the course of telephone-user research” (Karlin J E, 1957). Reading through these papers reveals how far the field of ergonomics has come and how far it has not. In some instances, the technology with which humans interact has changed out of all recognition, along with a considerable increase in the complexity of the systems in which these interactions occur. The underlying issues ergonomics aims to address, however, remain remarkably similar.

The cover page of the first issue in 1957 records the original full title of the journal: *Ergonomics: Human Factors in Work, Machine Control and Equipment Design*. The title is followed by the affiliation “The Official Publication of the Ergonomics Research Society”, with the imprint of the publisher, Taylor & Francis Ltd, London. The sub-title passed through various wording incarnations before it became the present day “*Ergonomics – The*

International Journal of Research and Practice in Human Factors and Ergonomics". The history and significance of the inclusion of 'human factors' and the subtle changes in wording and the debates around this would take too long to recount here. The Ergonomics Research Society later became the Ergonomics Society, then more recently the Institute of Ergonomics and Human Factors, before the grant of its Royal Charter in 2014. The journal continues to be the Official Journal of the Chartered Institute of Ergonomics and Human Factors.

The publishing agreement between the Ergonomics Research Society and Taylor & Francis arose from informal after-dinner conversations at St John's College Cambridge between Professor Alan Welford and Dr Henry Banister. Welford was then Chair of Council of the Ergonomics Research Society, set to become the founding Editor-in-Chief of *Ergonomics*; Banister was a fellow academic of Welford's at Cambridge and also a shareholder and director of Taylor & Francis. The relationship between the Institute, journal and publisher endures to this day as more than just a commercial business collaboration. It is interesting that although *Ergonomics* emerged from the Ergonomics Research Society and the founding of the discipline in the UK, the contents of the first issue had a strong international flavour, with contributions from authors from Germany, Netherlands and the USA. *Ergonomics* established its position as an international journal from the start. Readers interested in delving further into the history of the journal are referred to Edholm & Murrell (1973) and Waterson & Sell (2006).

Looking at the first issues of the journal, it is noticeable how much shorter the reference lists of papers were compared to today. Of course, these first authors were at the earliest stage of establishing the body of knowledge in ergonomics, with only limited previous research on which to build. In terms of changes to the character of the journal, Waterson and Sell (2006) undertook a content analysis of *Ergonomics* papers from 1957 to 1999, applying the categories developed by *Ergonomics Abstracts*. Waterson and Sell concluded that the distribution of content had remained broadly consistent, apart from a growth of papers in areas addressing 'Workplace and equipment design', 'Health and safety' and 'Methods and techniques'. There are no metrics or other sources from the early years to identify the most influential papers at that time. Using Scopus® citation counts from the present, the most cited of the papers published in 1957-58 are given in Table 1. The areas these papers addressed have gone on to become major strands of ergonomics research to the present day. Examining papers from across all years of *Ergonomics*, Table 2 lists the ten most cited papers over the 60 years of the journal's archive. It is easy to recognise seminal papers amongst these, which have had a major influence on knowledge and practice in ergonomics.

Tables 1 and 2 about here

Looking at contemporary articles attracting attention, Table 3 lists the most cited papers published in each of the years 2015 and 2016, whilst Table 4 identifies the most downloaded papers from the *Ergonomics* website for the same period. Although there is some overlap, we know that papers which attract reader interest are often not the same as

those that will be used, drawn upon and cited by future research (Haslam, 2007). Altmetrics, a recent addition to the scene, provide information about the wider attention scholarly output receives, its reach, influence and impact. Altmetrics are a measure of the conversations that are happening about papers across a range of social and other media, identifying what is 'trending' at present. Table 5 lists the papers with the highest Altmetric in 2016, from all years of publication of *Ergonomics*. It is interesting that the article by Rolnick & Lubow (1991) on car drivers' motion sickness, is being discussed today, 25 years after publication.

Tables 3-5 about here

Identifying trends from Tables 3-5, research into musculoskeletal disorders continues to have a strong presence. There is an understandable interest in issues associated with the use of now ubiquitous smart phone and tablet devices. There also seems to have been something of a renaissance of sociotechnical systems theory and thinking. Research concerning patterns of work, shift work and office work, are also to the fore at present. Regarding the later, there is significant interest currently in the interactions between office design, office environments, office work and office workers' performance and health. No doubt this reflects the considerable increase in numbers of people who now work in offices, working at computers, doing sedentary jobs.

Misappropriating a quotation from Niels Bohr, prediction is very difficult, especially if it is about the future. With a degree of trepidation, this Editor's forecast for the future of *Ergonomics* is that there will be increasing coverage over coming years of research concerned with:

- the ongoing major challenges in healthcare ergonomics
- driverless cars and other automated road vehicles
- intelligent automation, including trust and ethical aspects
- human factors aspects of cybersecurity
- interacting with the internet of things
- designing, analysing and optimising increasingly complex systems
- space exploration, stimulated by NASA's 'Journey to Mars'
- wide facets of sustainability

In certain areas our evidence for practice is weak (e.g. van der Molen et al, 2012; Leider et al, 2015; Chang et al, 2016). We hope to be publishing papers that build the evidence base for ergonomics interventions: high quality studies, prospective rather than cross-sectional designs and robust sample sizes. There is also a need for research addressing the challenge identified by Straker & Mathiassen (2009): increasing physical activity through the way work is organised and done. We need to understand how to design jobs that are productive, safe and fulfilling, whilst also being good for health, integrating rather than eliminating physical activity and mental demands (Jones et al, 2017).

Ergonomics endeavours to publish high quality papers, reporting research that makes a substantive contribution to contemporary science and articles which have an impact on

ergonomics practice or debate. The present editors have welcomed ‘unusual’ submissions, working with authors to reach a form of manuscript suitable for publication, whilst still satisfying the requirements of rigorous independent peer review. Examples that come to mind are Dul et al (2012), outlining an ambitious strategy for the future of human factors and ergonomics, along with Hancock’s (2014) polemic, challenging the move towards ever increasing automation. During the past 10 years, *Ergonomics* has published 13 Special Issues, on topics ranging from the brain computer interface; sport and leisure ergonomics; to gender, women’s work and ergonomics. An ongoing series of well received editor led State of Science reviews has been initiated. The two most recent of these on mental workload (Young et al, 2015) and occupational slips, trips and falls (Chang et al, 2016) feature in the lists of most cited, most accessed recent papers in Tables 3 and 4. Another innovation supported by our publishers has been experimenting with cartoon abstracts. Four of these have appeared to date: Your Open Plan Office Can Make You Ill! (Danielsson et al, 2014); Tablet Use Increases Neck Strain (Vasavada et al, 2015); Hard Knocks and High Heels (Hapsari & Xiong, 2016); and Surf Smart: Thick Boards and Long Paddles (Ekmecic et al, 2017). These cartoons provide a novel, lively means of disseminating the findings of research in the journal beyond its traditional readership (the cartoons can be accessed via the article web pages as supplemental material).

Since its inception in the 1950’s, *Ergonomics* has aged to become an established, respected, successful academic journal. Over the course of its 60 years, *Ergonomics* has had seven overseeing editors, variously titled Editor-in-Chief or General Editor: Professor Alan Welford (1957-1963), Dr Harry Maule (1964-70), Professor Peter Davis (1971-1974), Dr Ivan Brown OBE (1975-80), Professor Rainer Goldsmith (1980-1994), Professor Rob Stammers (1995-2006) and currently Professor Roger Haslam (2007-). Many other assisting editors, too many to mention here, have played a substantial part in the journal’s work. The vision, commitment and efforts of all these individuals lies behind *Ergonomics*’ present day success. As *Ergonomics* enters its 60th year, the journal is mature, thriving and still leading the way.

Roger Haslam
Editor-in-Chief
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Table 1. Most frequently cited papers from *Ergonomics* 1957-58 in descending order of citation frequency (data from Scopus®, December 2016)

Authors	Title
de Jong (1957)	The effects of increasing skill on cycle time and its consequences for time standards
Floyd & Roberts (1958)	Anatomical and physiological principles in chair and table design
Pepler (1958)	Warmth and performance: An investigation in the tropics
Whitney (1958)	The strength of the lifting action in man
Broadbent (1957)	Effects of noises of high and low frequency on behaviour

Table 2. Most frequently cited papers from *Ergonomics* 1957-2016 in descending order of citation frequency (data from Scopus®, December 2016)

Authors	Title
Waters et al (1993)	Revised NIOSH equation for the design and evaluation of manual lifting tasks
Reason et al (1990)	Errors and violations on the roads: A real distinction?
Saykrs (1973)	Analysis of heart rate variability
Corlett & Bishop (1976)	A technique for assessing postural discomfort
Monod & Scherrer (1965)	The work capacity of a synergic muscular group
Snook (1978)	The Ergonomics Society: The Society's Lecture 1978. The design of manual handling tasks.
Poole et al (1988)	Metabolic and respiratory profile of the upper limit for prolonged exercise in man
Snook & Ciriello (1991)	The design of manual handling tasks: Revised tables of maximum acceptable weights and forces
Lee and Moray (1992)	Trust, control strategies and allocation of function in human-machine systems
Marras et al (1995)	Biomechanical risk factors for occupationally related low back disorders

Table 3. Most frequently cited papers from *Ergonomics* published in 2015-2016 in descending order of citation frequency for each of these years (data from Scopus®, December 2016)

Authors	Title
Young et al (2015)	State of science: mental workload in ergonomics
Leider et al (2015)	Effects of job rotation on musculoskeletal complaints and related work exposures: a systematic literature review
Read et al (2015)	Designing sociotechnical systems with cognitive work analysis: putting theory back into practice
Lee et al (2015)	Head flexion angle while using a smartphone
Carayon et al (2015)	Advancing a sociotechnical systems approach to workplace safety – developing the conceptual framework
Vedaa et al (2016)	Systematic review of the relationship between quick returns in rotating shift work and health-related outcomes
Xie et al (2016)	A comparison of muscle activity in using touchscreen smartphone among young people with and without chronic neck–shoulder pain
Coenen et al (2016)	Towards exposure limits for working postures and musculoskeletal symptoms – a prospective cohort study
Reimer et al (2016)	Multi-modal demands of a smartphone used to place calls and enter addresses during highway driving relative to two embedded systems
La Delfa & Potvin (2016)	Multidirectional manual arm strength and its relationship with resultant shoulder moment and arm posture

Table 4. Most frequently download papers from *Ergonomics* published in 2015-2016 in descending order of frequency of access for each of these years (data from Taylor & Francis Online, December 2016)

Authors	Title
Vasavada et al (2015)	Gravitational demand on the neck musculature during tablet computer use
Baek & Min (2015)	Blue light aids in coping with the post-lunch dip: an EEG study
Young et al (2015)	State of science: mental workload in ergonomics
Leider et al (2015)	Effects of job rotation on musculoskeletal complaints and related work exposures: a systematic literature review
van de Ven et al (2015)	Need for recovery among male technical distal on-call workers
Chang et al (2016)	State of science: occupational slips, trips and falls on the same level
Dobres et al (2016)	Utilising psychophysical techniques to investigate the effects of age, typeface design, size and display polarity on glance legibility
Hapsari and Xiong (2016)	Effects of high heeled shoes wearing experience and heel height on human standing balance and functional mobility
Raffler et al (2016)	Factors affecting the perception of whole-body vibration of occupational drivers: an analysis of posture and manual materials handling and musculoskeletal disorders
Russell et al (2016)	A randomised control trial of the cognitive effects of working in a seated as opposed to a standing position in office workers

Table 5. Papers published in *Ergonomics* 1957-2016 with the highest Altmetric in 2016 (at December 2016)

Authors	Title
Kaarlela-Tuomaala (2009)	Effects of acoustic environment on work in private office rooms and open-plan offices - longitudinal study during relocation
Vasavada et al (2015)	Gravitational demand on the neck musculature during tablet computer use
Danielsson et al (2014)	Office design's impact on sick leave rates
Pan et al (2011)	Numerical studies on the microclimate around a sleeping person and the related thermal neutrality issues
Bridger et al (2013)	Occupational stress and employee turnover
Rolnick and Lubow (1991)	Why is the driver rarely motion sick? The role of controllability in motion sickness
Küller et al (2006)	The impact of light and colour on psychological mood: a cross-cultural study of indoor work environments
Richardson et al (2017)	Nature: a new paradigm for well-being and ergonomics
Sluiter (1999)	The influence of work characteristics on the need for recovery and experienced health: a study on coach drivers
Hapsari and Xiong (2016)	Effects of high heeled shoes wearing experience and heel height on human standing balance and functional mobility