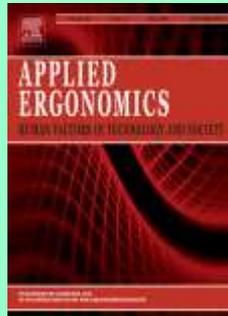


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Andrew Thatcher, Paul H.P. Yeow. *Human factors for a sustainable future. Pages 1-7.*

Current human activities are seriously eroding the ability of natural and social systems to cope. Clearly we cannot continue along our current path without seriously damaging our own ability to survive as a species. This problem is usually framed as one of sustainability. As concerned professionals, citizens, and humans there is a strong collective will to address what we see as a failure to protect the natural and social environments that supports us. While acknowledging that we cannot do this alone, human factors and ergonomics needs to apply its relevant skills and knowledge to assist where it can in addressing the commonly identified problem areas. These problems include pollution, climate change, renewable energy, land transformation, and social unrest amongst numerous other emerging global problems. The issue of sustainability raises two fundamental questions for human factors and ergonomics: which system requires sustaining and what length of time is considered sustainable? In this paper we apply Wilson (2014) parent-sibling-child model to understanding what is required of an HFE sustainability response. This model is used to frame the papers that appear in this Special Issue.

- **Keywords:** Sustainability; Systems theory; Human factors for sustainable development

Monique Lortie, Sylvie Nadeau, Steve Vezeau. *Holistic sustainable development: Floor-layers and micro-enterprises. Pages 8-16.*

Attracting and retaining workers is important to ensuring the sustainability of floor laying businesses, which are for the most part micro-enterprises (MiE). The aim of this paper is to shed light on the challenges MiE face in OHS implementation in the context of sustainable development. Participative ergonomics and user-centred design approaches were used. The material collected was reviewed to better understand the floor layers' viewpoints on sustainability. The solutions that were retained and the challenges encountered to make material handling and physical work easier and to develop training and a website are presented. The importance of OHS as a sustainability factor, its structuring effect, what distinguishes MiE from small businesses and possible strategies for working with them are also discussed.

- **Keywords:** Sustainable development; Occupational health and safety; Design

I.-L. Engkvist, J. Eklund, J. Krook, M. Björkman, E. Sundin. *Perspectives on recycling centres and future developments*. Pages 17-27.

The overall aim of this paper is to draw combined, all-embracing conclusions based on a long-term multidisciplinary research programme on recycling centres in Sweden, focussing on working conditions, environment and system performance. A second aim is to give recommendations for their development of new and existing recycling centres and to discuss implications for the future design and organisation. Several opportunities for improvement of recycling centres were identified, such as design, layout, ease with which users could sort their waste, the work environment, conflicting needs and goals within the industry, and industrialisation. Combining all results from the research, which consisted of different disciplinary aspects, made it possible to analyse and elucidate their interrelations. Waste sorting quality was recognized as the most prominent improvement field in the recycling centre system. The research identified the importance of involving stakeholders with different perspectives when planning a recycling centre in order to get functionality and high performance. Practical proposals of how to plan and build recycling centres are given in a detailed checklist.

- **Keywords:** Environment; Sustainability; Waste

Thomas Franke, Nadine Rauh, Josef F. Krems. *Individual differences in BEV drivers' range stress during first encounter of a critical range situation*. Pages 28-35.

It is commonly held that range anxiety, in the form of experienced range stress, constitutes a usage barrier, particularly during the early period of battery electric vehicle (BEV) usage. To better understand factors that play a role in range stress during this critical period of adaptation to limited-range mobility, we examined individual differences in experienced range stress in the context of a critical range situation. In a field experiment, 74 participants drove a BEV on a 94-km round trip, which was tailored to lead to a critical range situation (i.e., small available range safety buffer). Higher route familiarity, trust in the range estimation system, system knowledge, subjective range competence, and internal control beliefs in dealing with technology were clearly related to lower experienced range stress; emotional stability (i.e., low neuroticism) was partly related to lower range stress. These results can inform strategies aimed at reducing range stress during early BEV usage, as well as contribute to a better understanding of factors that drive user experience in low-resource systems, which is a key topic in the field of green ergonomics.

- **Keywords:** Battery electric vehicle; Range anxiety; Range stress; Individual differences

Anastasia Kalantzis, Andrew Thatcher, Craig Sheridan. *Mental models of a water management system in a green building*. Pages 36-47.

This intergroup case study compared users' mental models with an expert design model of a water management system in a green building. The system incorporates a constructed wetland component and a rainwater collection pond that together recycle water for re-use in the building and its surroundings. The sample consisted of five building occupants and the cleaner (6 users) and two experts who were involved with the design of the water management system. Users' mental model descriptions and the experts' design model were derived from in-depth interviews combined with self-constructed (and verified) diagrams. Findings from the study suggest that there is considerable variability in the user mental models that could impact the efficient functioning of the water management system. Recommendations for improvements are discussed.

- **Keywords:** User mental models; Expert design models; Constructed wetlands; Water management system; Green ergonomics

Kirsten M.A. Revell, Neville A. Stanton. *Mind the gap: Deriving a compatible user mental model of the home heating system to encourage sustainable behaviour.* Pages 48-61.

Householders' behaviour with their home heating systems is a considerable contributor to domestic energy consumption. To create a design specification for the 'scaffolding' needed for sustainable behaviour with home heating controls, Norman's (1986) Gulf of Execution and Evaluation was applied to the home heating system. A Home Heating Design Model (DM) was produced with a home heating expert. Norman's (1986) 7 Stages of Activity were considered to derive a Compatible User Mental Model (CUMM) of a typical Heating System. Considerable variation in the concepts needed at each stage was found. Elements that could be derived from the DM supported stages relating to action specification, execution, perception and interpretation, but many are not communicated in the design of typical heating controls. Stages relating to goals, intentions and evaluation required concepts beyond the DM. A systems view that tackles design for sustainable behaviour from a variety of levels is needed.

- **Keywords:** Mental models; Design: sustainability; Behaviour change; Design model

Martha H. Saravia-Pinilla, Carolina Daza-Beltrán, Gabriel García-Acosta. *A comprehensive approach to environmental and human factors into product/service design and development: A review from an ergoecological perspective.* Pages 62-71.

This article presents the results of a documentary-exploratory review of design methods and concepts associated with human and environmental factors, based on a qualitative-quantitative analysis of coincidences with the fundamentals of ergoecology and in line with sustainable dynamics, with a view to putting the principles of ergoecology into practice in product/service design and development. 61.6% of 696 documents found represent work on conceptual developments, while the remaining 38.4% refer to design methods. Searches were refined using Nvivo-10 software, and 101 documents were obtained about theoretical aspects while 17 focused on the application of methods, and these formed the analysis universe. The results show how little concern there is for working comprehensively on human and environmental aspects, and a trend toward segmentation of human and environmental aspects in the field of product/service design and development can be seen, at both concept and application/methodology levels. It was concluded from the above that comprehensive, simultaneous work is needed on human and environmental aspects, clarity and conceptual unity, in order to achieve sustainability in practical matters and ensure that ergoecology-compatible design methods are applied.

- **Keywords:** Human factors/ergonomics HFE; Sustainability; Design methods

Ivan Bolis, Claudio M. Brunoro, Laerte I. Sznelwar. *Work for sustainability: Case studies of Brazilian companies.* Pages 72-79.

The introduction of strategic corporate sustainability policies is expected to result in the improvement of several issues in companies. One of these issues is work, which should involve greater well-being for workers. Within the context of production engineering, this research connects sustainability and work-related issues, the latter seen in light of the discipline of ergonomics. Based on case studies conducted at four companies considered sustainability benchmarks, we examined how the introduction of the theme of

sustainability has influenced work-related issues. The elements analyzed here were the corporate sustainability strategy, organizational practices for deploying the strategy, and the work design phase. The last element is the moment in which work is prescribed in the organization. The results show that, despite the announcement of the inclusion of changes in work, there is not any explicit evidence confirming that such changes are considered as a requirement for corporate sustainability projects.

- **Keywords:** Work design; Corporate sustainability; Ergonomics; Production engineering; Strategy; Operations

Wai Ching Poon, Gamini Herath, Ashutosh Sarker, Tadayoshi Masuda, Ryohei Kada. *River and fish pollution in Malaysia: A green ergonomics perspective*. Pages 80-93.

Human activities, such as industrial, agricultural, and domestic pursuits, discharge effluents into riverine ecological systems that contains aquatic resources, such as fish, which are also used by humans. We conducted case studies in Malaysia to investigate the impacts of these human activities on water and fish resources, as well as on human well-being from an ergonomics perspective. This research shows that a green ergonomics approach can provide us with useful insights into sustainable relationships between humans and ecology in facilitating human well-being in consideration of the overall performance of the social-ecological system. Heavy metal concentrations contained in the effluents pollute river water and contaminate fish, eventually creating significant health risks and economic costs for residents, including the polluters. The study suggests a number of policy interventions to change human behavior and achieve greater collaboration between various levels of government, academia, civil society, and businesses to help establish sustainable relationships between humans and ecology in Malaysia.

- **Keywords:** Green ergonomics; Human factors; Heavy metal pollution; Sustainable development

Ananda Samudhram, Eu-Genie Siew, Jothee Sinnakkannu, Paul H.P. Yeow. *Towards a new paradigm: Activity level balanced sustainability reporting*. Pages 94-104.

Technoeconomic paradigms based economic growth theories suggest that waves of technological innovations drove the economic growth of advanced economies. Widespread economic degradation and pollution is an unintended consequence of such growth. Tackling environmental and social issues at firm levels would help us to overcome such issues at macro-levels. Consequently, the Triple Bottom Line (TBL) reporting approach promotes firm level economic, environmental and social performances. Incorporating Zink's (2014) 3-pillar presentation model, this paper indicates that economic, social and environmental performances tend to be reported at firm level. All three pillars are not covered evenly at the activity levels. Thus, a loophole is identified whereby excellent environmental performance at activity levels could potentially leave poor social performance undisclosed. A refinement of the TBL paradigm, whereby all three pillars are covered at the activity level, is suggested, to enhance sustainability reporting.

- **Keywords:** Triple bottom line; Global reporting initiative; Sustainability reporting; Human factors