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Editorial

Advances in sociotechnical systems understanding and design: A Festschrift in honour of K.D. Eason

1. Introduction

The literal meaning of the German word 'Festschrift' is a written celebration. Sometimes, the Latin term '*liber amicorum*' (a 'book of friends') is also used. This special issue of Applied Ergonomics is perhaps best thought of as an attempt to combine the two. We wanted to celebrate the work of Professor K.D. (Ken) Eason and his contribution over the course of the last 40 years to a tradition central to human factors and ergonomics, namely sociotechnical systems theory and its application. A second aim was to provide some indication of the breadth and range of that work though papers drawn from the colleagues he has worked both from the past as well as the present. One note of caution – the publication of the Festschrift should in no way be taken as an 'endpoint' for Ken, far from it! He continues to research, give talks, write and do all of the things which have made him one of the most widely respected, cherished and liked people in the field. Long may it last! In what follows, we briefly summarise some of the main stages of Ken's career over the last 40 years (Section 2). Section 3 provides further details by focussing on one decade in this career as seen through the eyes of two colleagues who worked as part of the Human Sciences and Advanced Technology (HUSAT) group at that time (Tom Stewart and Leela Damodaran). The final section provides an overview of the 8 papers in the Festschrift. The Festschrift concludes with an 'afterword' written by Ken Eason which offers some reflections and observations on the collection of papers.

2. A career in sociotechnical systems

Ken's career began in 1968 at EMI Electronics, one of the earliest commercial laboratories for ergonomics (Eason, 2009; Waterson and Eason, 2009). One of his first tasks was an observational study of engineers using 'teletypes', early computer consoles designed to support work tasks. The study showed that only 40% of the time spent by the engineers using the teletype machines proved to be productive. The other 60% was wasted in waiting for the computer to respond, reading through the manual or trying to decipher error messages. So began a career focused on information technology and sociotechnical systems and covering, amongst other things, requirements engineering, information systems procurement, human factors and usability and the management of sociotechnical change. Together, this work culminated in a number of influential publications including 'Information Technology and Organisational Change' (1988) and 'Putting Social Science to Work' (with Lisl Klein, 1991). Along the way Ken has helped and inspired countless undergraduate and postgraduate students in his various roles at Loughborough and elsewhere (Table 1).

His service to human factors and ergonomics has been recognised by a number of academic and professional institutions including an honorary Doctor of Science (DSc) from Chalmers University of Technology in Gothenburg and the UK Institute of Ergonomics and Human Factors (the Bartlett Medal in 1985 and again in 1992 for his role in the Human Factors in Information Technology Team at HUSAT). In these days of bibliometrics, h-indices and citation rating it is hard to put a value on Ken's publications. Suffice to say, he has had enormous influence on the field of human factors and ergonomics, as well as organisational psychology and systems design. The list goes on and continues to grow! Above all, Ken, as countless colleagues and collaborators will confirm, is a joy to work with. Anyway, enough of the present, it's time to go back to the 1970's.

3. Ken Eason in the 1970's

August 1970 – flares and long hair were 'in' and Loughborough University of Technology welcomed ten new researchers to an embryonic research group started by Professor Brian Shackel and Ken Eason in the then Department of Ergonomics and Cybernetics (later becoming the Department of Human Sciences). Brian had headed up a successful ergonomics group at EMI before persuading the university to fund Ken Eason (who had worked with him at EMI) and nine others for at least a year conducting applied research in

Table 1
A timeline of Ken's Eason career.

1969	Occupational Psychologist, EMI Electronics
1970	Deputy Director, HUSAT Research Group and Research Fellow, Loughborough University of Technology
1971	Lecturer, Department of Ergonomics and Cybernetics, Loughborough University
1978–1989	Senior Lecturer, Lecturer and Reader in Cognitive Ergonomics
1989–2002	Professor of Cognitive Ergonomics 1989–1993/2000–2002 Head of the Department of Human Sciences, Loughborough University 1992–1996 Director of the HUSAT (Human Sciences and Advanced Technology) Research Institute 1999–2000 Director, Research School in Ergonomics and Human Factors
2002–	Emeritus Professor of Cognitive Ergonomics
2002–2007	Director, The Bayswater Institute
2007–	Senior Consultant, The Bayswater Institute

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ergonomics and new technology. The whole lot of us were acquired for less than £10K – funded by an innovation grant from the University which was to cover salaries and other costs for a twelve month period. Thrift was the watchword however, and our desks (not yet called 'workstations') and book shelves were constructed by the Departmental carpenter and all-round Mr. Fix-It – George Clibbery. George was a renowned character for many reasons, not least of which was his highly non-PC picture gallery lining the cupboard doors in the workshop.

One of our first tasks was to create a name and mindful that computers and ergonomics were both rapidly becoming much broader in scope than just dealing with one person working at a computer, a protracted creative process ensued. After some intense (mostly amicable) deliberation, we eventually chose the name HUSAT – Human Sciences and Advanced Technology. (The group soon became known locally as 'Monty Shackel's Flying Circus'). We were a very mixed bunch from psychologists and industrial designers to computer scientists but we all shared an excitement and passion for the world of 'new technology' and its implications for people and their lives. Leela had known Ken from his days at Brunel University but most of us were new to Loughborough and each other.

Although Brian was clearly in charge, Ken was his second in command. We were based off campus at the Elms (currently home to the Institute of Ergonomics and Human Factors, then known as the Ergonomics Research Society). Ken was more like a big brother (in the nice sense) to this new group of researchers and could always be relied on the provide support and encouragement. In similar vein, he went on to sustain several generations of students through their studies and PhD research. Although external funding was going to be needed, this was not an immediate priority and we enjoyed informal collaborations with Chris Evans at the National Physical Laboratory and John Pinkerton one of the pioneers of business computing at International Computers Limited (ICL). Those were very different times. One of Tom's earliest internal assignments was to produce a cost benefit justification for stationing a secretary at the Elms, rather than sending handwritten reports and letters on the van to the main campus! This proved successful and an electronic typewriter was duly provided for Rita, the new secretary.

One of the first major externally funded projects in HUSAT was the MICA (man–computer interaction in commercial applications) survey. This was funded by the Social Science Research Council (SSRC). It involved Ken, Leela and Tom carrying out in-depth interviews to investigate the experience of 254 computer users and 73 systems staff from 26 computer systems in Britain. It would now be called ethnographics and we identified three distinct types of users – managers, specialists (engineers and similar) and administrative/clerical users. We shared the work with Leela focussing on administrative and clerical users, Tom on specialist users and Ken on managerial users. Our findings illustrated many of the challenges and opportunities which commercial data processing would face over the following decades. Tom remembers being with Ken interviewing one of what we called an 'indirect managerial user' i.e. he received printed reports which he had to ask for by submitting a form with tick boxes to select the variables. Having become frustrated that every time he asked a question (and waited for the overnight mainframe run to create the report) he would find that he had forgotten some vital aspect and had to run the report again … To avoid this problem, he had decided to tick every box. We were there when his report was wheeled into his office on a sack trolley – a three foot high pile of printout! Whether this was influential or not we don't know but Ken has made managers and computers a key focus of his research ever since and his papers on managers are widely regarded as the authoritative source.

What is clearly in evidence is the long-lasting significance of the pioneering work of the MICA survey which identified for the first time the crucial role of user support and the importance of developing sociotechnical – rather than solely technical – systems. These important findings and associated concepts characterised the research approach of HUSAT for many years and continue to have relevance and currency today for many aspects of our e-Society. In addition to providing the essential data collection opportunities, the MICA survey afforded the three of us some fascinating first-hand experiences of the sights and sounds of 1970s Britain. One memorable 'field trip' was to the Mersey Docks and Harbour Company where Ken and Leela were given a tour of the thriving port and marvelled at the huge, state of the art, containerisation technology in evidence. Their meetings with managers took place in the awe-inspiring building headquarters. MICA and subsequent studies also involved collaboration, often international. Both Leela and Tom well remember an early trip to a conference in Gothenburg in the nineteen seventies where we overdosed on crayfish and Tom and Ken nearly played football against Glasgow Rangers.

The crayfish experience put us off sea food for a considerable time. It is apparently a Swedish tradition to welcome the opening of the crayfish season with a crayfish feast and all three of us were pleased when the conference organisers invited us to this event at a famous restaurant. We each duly consumed an entire plate of delicious crayfish and foolishly wondered what the next course was. It was more crayfish and yet more crayfish all through the evening. We couldn't face seafood for some months afterwards. We were staying at a special sports hotel well known for its training facilities. One day at breakfast, we discovered that the long haired young men at the next table were from Glasgow Rangers preparing for a forthcoming European football match. The players were a chatty bunch and responded well to the suggestion of a friendly football match between researchers and footballers that evening. However, as soon as their manager heard about it, the fixture was off – apparently even rank amateurs can inflict unwelcome injuries on star players. Of course, even for the research team, it is unlikely that Ken or Tom would have been playing – football not being big on either agenda – but it's nice to dream. One sport which Ken was excited about was cricket and he would sit at his desk in the Elms with his transistor radio (yes it was that long ago) playing the commentary.

Surprisingly few years after having to justify an electric typewriter, HUSAT took possession of its first computer – a PDP 12 made by the Digital Equipment Corporation (DEC). In those days, the computer industry was dominated by IBM but DEC had a reputation for being innovative and their PDP series was widely regarded as the computer for researchers. Ken was not one of the researchers who became hooked on lunchtime Space invaders, a primitive computer game which despite its extremely limited graphics (a spaceship was just 5 dots shaped like an arrow) required the computer to stop doing anything useful while the game was played. Around the same time, our collaboration with the National Physical Laboratory (NPL) exposed us to DARPANET a US military funded network which eventually morphed into the internet. At that time, the NPL researchers were sending each other messages down the corridor using this computer network and packet switching (which we believe was developed at NPL). Being more interested in the business use of computers, we rather superiorly couldn't see much future in computer games or email – how wrong can you be?

But Ken has generally been more right than wrong and over the years has been a firm advocate of the sociotechnical approach which owes its origins to the early organisational interventions of the Tavistock Institute. Lisl Klein was one of the gurus who willingly entertained the young HUSAT researchers in what can only be

described as a 'grand tour' of major research facilities which marked the beginning of an incredible research journey. Lisl's deep influence on Ken's work has its origins in her work at Esso and links with Brian Shackel and Ken at that time. That influence and collaboration continues to the present day with Ken's ongoing involvement with the Bayswater Institute. In 1978 Ken became a Senior Lecturer and his time was shared between growing departmental responsibilities and HUSAT projects for which he was responsible – including the Alvey Large Scale Demonstrator MAST (Machine Assisted Speech Transcription). Also in 1978, Ken was appointed Visiting Professor at Copenhagen Business School where he wrote the book 'Managing Computer Impact' with Niels Bjørn-Andersen and Dan Robey. For several years the 50:50 split of his time between HUSAT and the Department operated unofficially and successfully for all parties. One wonders if this kind of arrangement could still happen? From these reflections on Ken's early days in HUSAT, it is evident that Brian and Ken can take credit for creating a unique research group from scratch. The interdisciplinary applied focus came from the diverse backgrounds of the different team members. As HUSAT grew, it tended to attract like-minded people but in the beginning it was only Brian and Ken's vision that linked us. Ken's own emerging specialism in cognitive ergonomics developed through the late 1970s and early 1980s.

The discipline of Cognitive Ergonomics in relation to Information Technology was unknown in the early 1970s but became a thriving research area with Ken as one of the few international figures in this field in the UK. This achievement was reflected by external acknowledgements of scientific reputation which included the award of the Bartlett Medal (the premier research award of the Ergonomics Society) on two occasions, a unique achievement. The award in 1985 was for personal contribution to the development of ergonomics in relation to information technology. Ken's scientific reputation at that time was based on work on four related topics:

(i) Modelling of computer users. Ken's work on the MICA survey and on his doctoral research involved many empirical studies of the behaviour of computer users (especially of managers as computer users). These studies were widely regarded as important contributions to the identification of usability and acceptability as barriers to the effective utilisation of computer systems by non-specialist users.
(ii) Information technology and organisational change. Through a series of studies the impact of information technology upon organisations, including an international study of the impact upon management systems, Ken demonstrated the mechanisms whereby technical changes lead to organisational changes and proposed and tested evolutionary, user-centred design methods to ensure technical and organisational developments are jointly planned and implemented.
(iii) Information technology systems design methods. The (then) SERC-funded Alvey and ESPRIT research investigated the methods of systems design used in practice in suppliers and in user organisations. This work attracted attention because it revealed the difference between the theory and the practice of systems design and demonstrated the influence of social and political issues in what was predominantly regarded as a rational, technical process.
(iv) The development of human factors techniques and tools. Through the 1980s, Ken guided members of the HUSAT research centre in the development of many tools and techniques to promote human-centred design. This work took place in the ESPRIT HUFIT project for IT suppliers, and in the MOD HF Guidelines project for large scale procurement programmes and in a variety of projects, for large and small user organisations.

There are key themes from this formative period which Ken continued – and continues – to develop. One of these relates to the development of information technology systems to meet the demands of complex organisations. In the 1980s there was a developing recognition in the information technology community that traditional methods were inadequate in specifying, designing and implementing these systems. To investigate and address 'multi-user systems', and 'co-operative work support systems', Ken undertook research on organisational aspects of computer impact through a major collaborative project funded under ESPRIT II – the ORDIT project – which was a 5 year programme (probably the last of such large and long-duration EU-funded projects) to investigate the requirements for these systems and to develop methods for their design – informing subsequent work on complex systems.

In conclusion, this review of the early days of HUSAT and Ken's role as Deputy Director, then as Co-Director and subsequently Director of the HUSAT Research Centre (– later Institute), shows the significant part he played in the development of an institution which earned a well-established international reputation. Such is the influence and reputation built up over the three decades of its existence, that to this day, past users of HUSAT research still make reference to its work – and the value of its approach – although it is now more than a decade since HUSAT ceased to be a functioning entity. Kens' role in developing the expertise of HUSAT staff helped a number of them to become acknowledged experts in the field and to taking up significant posts in academia and in commercial organisations. This legacy continues to have value and to enhance the experience of users of information and communications technologies in diverse contexts.

4. The papers in the Festschrift

The first paper in the Festschrift is written by Lisl Klein, a long-term collaborator of Ken's and colleague at the Bayswater Institute in London ('*What do we actually mean by 'sociotechnical'? On values, boundaries and the problems of language*'). Klein's paper deals with one of the dilemmas involved in working within the sociotechnical systems tradition, namely pinning down and defining what is meant by sociotechnical systems. The paper focuses on the importance of understanding the nature of interdependencies between the social and technological part of the work system and draws on a number of case studies carried out by the author and in collaboration with Ken Eason. The second paper by Dave Wastell and Sue White ('*Making sense of complex electronic records: Socio-technical design in social care*') describes some of their recent work examining the use of electronic records in social care. They apply socio-technical and user-centred design not only to problems associated with the use of the Integrated Children's System (ICS) for social care, but also the design of a novel interface (the BRIGIT 'micro-world') in order to overcome these difficulties. The paper by Patrick Waterson ('*Health information technology and sociotechnical systems: a progress report on recent developments within the UK National Health Service (NHS)*') similarly reports on attempts to introduce electronic record systems, but this time within the larger context of the UK National Health Service. This paper describes a set of case studies carried out in the last few years within various healthcare settings and draws extensively on recent work carried out with Ken Eason. Martin Maguire's paper ('*Socio-technical systems and interaction design – 21st century relevance*') is an attempt to update and apply sociotechnical thinking as it applies to interaction design covering changes to job and user roles, work processes and the technical infrastructure. The paper concludes with a set of guidelines, the aim of which is to incorporate sociotechnical design thinking in order to produce usable and acceptable systems. Matt

Davis, Rose Challenger, Dharshan Jayewardene and Chris Clegg (‘*Advancing socio-technical systems thinking: A call for bravery*’) makes the case for applying sociotechnical thinking to a wider range of contexts and application domains, as compared to its earlier, narrower focus on new technology and work. The paper illustrates how a more radical sociotechnical ‘agenda’ might work in practice using examples drawn from the management of crowd events and environmental sustainability. Neil Doherty’s paper (‘*The role of socio-technical principles in leveraging meaningful benefits from IT investments*’) compares a set of sociotechnical propositions developed by Eason (1988) with principles derived from work within information systems on ‘Benefits Realisation Management’ (BRM). The paper concludes that a great deal of current research on BRM has its roots in earlier work within sociotechnical systems theory, including the work of researchers such as Enid Mumford, Chris Clegg, P.G. Herbst and Ken Eason. A similar organisational information systems perspective is provided by Nils Bjørn-Andersen and Benoit Raymond (‘*The impact of IT over five decades – Towards the Ambient Organization*’). They provide a historical and sociotechnical analysis of changes to the functioning and structuring of organisations over the last fifty years. A key development is the increased use of information technology to underpin business sourcing arrangements (i.e., procuring products, services, resources) and the move towards what the authors characterise as ‘ambient organisations’. The final paper by Theoni Koukoulaki (‘*The impact of lean production on musculoskeletal and psychosocial risks: An examination of sociotechnical trends over 20 years*’) provides a review of previous studies which have examined the relationship between lean production and a range of employee psychosocial and physical risks. The review concludes that there are further opportunities to apply sociotechnical concepts and ideas within lean manufacturing, not least in terms of Ken Eason’s recent work on the nature of task interdependencies and tight/loose coupling.

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