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### **A question of our marketing or our preconceptions: Commentary on the paper 'A strategy for human factors/ergonomics: developing the discipline and profession'**

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## A question of our marketing or our preconceptions: Commentary on the paper ‘A strategy for human factors/ergonomics: developing the discipline and profession’

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The present paper is a commentary on the recently published IEA strategy for human factors/ergonomics (Dul, J., *et al.* (2012), A strategy for human factors/ergonomics: developing the discipline and profession. *Ergonomics*, 55(4), 377–395). Two main issues that demand attention are: (i) the way others understand our profession and discipline, and (ii) the way we understand our profession and added value to industry. First, it is advocated that the discussion on the future of human factors/ergonomics (HFE) should be focused more on the quality of the delivered value of HFE and less on its visibility and marketing. Second, the three fundamental characteristics of HFE, as proposed in the report, are discussed and the consequences of this proposal are further developed. Arguments are put forward on the endemic epistemological vagueness within the discipline and on the optimistic definition of its aim. Finally, a proposal is made at the epistemological level, which challenges some established convictions of the discipline. It is advocated that such an epistemological evolution may be necessary if HFE is to make progress towards contributing to system performance.

**Practitioner Summary:** The paper is a commentary on the IEA strategy for human factors/ergonomics. Issues discussed are, the way others understand our profession and the way we understand our profession and added value to industry. Some of the established convictions of the discipline are challenged and proposals are made to overcome these.

**Keywords:** future of ergonomics; marketing; positivism; systems; design

### Introduction

In 2010, the International Ergonomics Association formed a committee to develop a strategy for the future development of human factors/ergonomics (HFE). The recently published paper ‘A strategy for human factors/ergonomics: developing the discipline and profession’ (Dul *et al.* 2012) resulted from their deliberations. The committee has made a formidable effort to integrate and harmonise the views and concerns of many prominent colleagues from around the globe and the outcome does justice to this effort.

The present paper is a reflection vis-à-vis the report. We recognise both the process and the result as highly successful and are supportive of its main theses. We were given the opportunity to, and did, provide comments on a draft version of the report and thus have contributed to its outcome. Nevertheless, the present paper is written as a critique to provoke introspection and thus to contribute to a fertile discussion within the ergonomics community.

There are two lines of thought in the report that, in our opinion, demand proper attention; how others understand our profession and discipline, and how we understand it, particularly regarding our added value to industry. In the first part of the paper on how others understand our profession, we challenge the emphasis given in the report to promotion activities towards decision makers, and propose a more pragmatic approach to our relation with industry. In the second part of how we understand our discipline, we further develop the fundamental characteristics of HFE as proposed in the report, and provide arguments towards the possible epistemological consequences resulting from these. To conclude, we suggest that the internal discussion about the future of HFE should give more emphasis at questioning our effectiveness and our long-standing preconceptions than it should remind us of our merits.

### How others understand our profession and discipline

An important thesis of the report is that although HFE is indeed unique, original and of definite added value to our evolving technological culture, its development regarding system performance has been slow and its effectiveness questionable.

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As a main reason for the above, the report identifies a limited awareness of stakeholders with decision-making power as to the potential value of HFE. It is advocated that the limited awareness of these decision makers inhibits the progress of the discipline and suggestions are made on how to overcome it. More specifically, emphasis is put on communicating the possible system performance gains from applying HFE, an issue considered crucial for stakeholders with decision power. Suggestions in the report are mainly of the promotion type, pointing at communicating the benefits of applying HFE to potential 'customers'.

We acknowledge that in order to contribute to future system design, HFE must demonstrate its value to the main stakeholders of system design. However, demonstrating the value of HFE for system performance is not only achieved by evangelising the possible benefits from applying it. Wherever our discipline had concrete and repeated successes (e.g. in military, patient safety, aviation, nuclear domains) it needed little marketing support to get established as an important partner in systems design. Communicating the potential benefits to stakeholders is fine, but in our view it is far more effective to demonstrate already delivered benefits by domain of application.

Concerning the 'limited awareness' of decision makers identified in the report, in our view, this is not a deficit specific to HFE. It is not HFE in particular that somehow demonstrates lower than average market appeal. Most of the so-called applied scientific disciplines, that we are familiar with, almost equivocally state the same concern (e.g. industrial engineering, operations research, human-computer interaction, industrial design, occupational hygiene, etc.). HFE as a discipline has been present in the industrial sector of the developed economies for more than 50 years now. In our view if our discipline has not gained the recognition that we expected it to have as a major contributor to productivity or 'system performance', this is mostly due to its average effectiveness up to now and less to its visibility and/or marketing per se. Therefore, in our view, HFE should put greater effort into the former, rather than the latter.

We believe that a discussion on the future of HFE should be strongly linked to a critical reflection on the mismatch between the potential and the delivered value of HFE, i.e. on the effectiveness of the current HFE practice internationally. The report does include such a reflection but, in our view, it is too general (we develop more on this topic later).

Concerning industrial demand for HFE, it is advocated in the report that the limited awareness of the potential value of HFE leads to limited demand. At first glance this reasoning sounds self-evident; if people are generally not aware of your added value they will not demand your services. However, one needs to reflect on what should be considered as demand for HFE. Commonly, in the typical HFE educated person's mind, a request of the type 'the ergonomic redesign of a work-station' or 'the study of working conditions of a workshop' or 'the ergonomic design of a control-room' would perfectly fit their expectation. Still, it is not an overstatement to claim that the majority of applied HFE projects do not start from an explicit request for HFE. An industrial client would rarely express an explicit demand for 'ergonomics' just as he rarely expresses an explicit demand for industrial engineering. He usually asks for help on why particular people complain or on why the competition manifests fewer defects or on how to rearrange the lighting of his shop floor. The above argument does not exclude that the client might have an idea of what type of knowledge would be more relevant to his problem, but the latter does not equate the former. True demand for HFE is highly sensitive to problem definition and on methodology proposed (termed contextualisation in the report). This contextualisation is the responsibility of every HFE professional and should be part of his/her competencies (Wisner 1995b, Wilson 2012). For industry at large it is of little relevance if a project is labelled ergonomics or something else; *what* one defines as the problem and *how* one intends to tackle it are the essential questions. Industrial demand does not always reflect the structure of the applied scientific disciplines. This is a fundamental problem that the HFE community (and many other scientific/professional communities) needs to address.<sup>1</sup> Past and recent successes of the HFE approach in certain domains support the above argument (e.g. in the fields of nuclear, aviation and patient safety). Once a problem is defined in a comprehensive manner (i.e. the system boundaries in the report's wording) and the ways of tackling it are clearly expressed in the language of the domain of concern, then it becomes less important how one calls oneself or the intervention.

In our view, HFE is a 'systems discipline' and not a business or academic buzzword; it does not resemble terms such as business process re-engineering (BPR) or customer value chain (CVC), nor user experience (UX), computer supported collaborative work (CSCW) or user-centred design (UCD), etc. Many highly successful HFE-trained professionals practice their trade under different domain centric/problem specific titles (e.g. usability engineer, user experience specialist, safety investigation professional). This is perfectly fine within a 'systems' approach to HFE.

We are obviously sceptical regarding the logic in the report that the limited general awareness directly leads to limited demand and with the proposed marketing strategy. Contrary to the report's recommendations, our position seems not to support the promotion of the label HFE to industry. This might sound peculiar to some and iconoclastic to others. The point however that we are trying to make is that the label HFE denotes a scientific

discipline not a particular service to industry. Therefore, alternative domain or expertise specific labels may be used in industry, as it is already the case in many countries. Insofar as one (i) adheres to the rigorous systemic analysis of the problem definition, (ii) bases his inquiry on empirical evidence, and (iii) respects the integrity and autonomy of the people affected, whatever the label used, he or she is proceeding in a manner consistent with the principles of Ergonomics. HFE should rigorously claim the scientific core of human-technology disciplines and accept that different labels will be used by domain of application or industry vogue.

### How we understand our discipline

The report identifies three fundamental characteristics of HFE: (i) that it adopts a systems approach, accepting that a broad set of human characteristics and aspirations interact with a broad set of elements in the environment, (ii) that it is design driven, and (iii) that it focuses on two related outcomes: performance and well-being.

Point (i) undoubtedly expresses a strong position. It echoes the definition of Ergonomics adopted by the IEA in 2000 but emphasises the systems approach. In our view, this position merits more elaboration as, if genuinely adopted, may profoundly affect the future of the discipline.

In fact there seems to be an endemic ambiguity within HFE as to its analytic (i.e. reductionist) or systemic nature and approach. Much of academic research tends to be analytic in order to conform to the orthodox scientific method (Meister 1999). On the other hand many endeavours in practice (i.e. those aiming to influence the real world) cannot avoid taking a systems approach (Wisner 1995b, Wilson 2000, 2012). Subsequently, this ambiguity extends also to the research orientation of HFE. Should HFE research be more focused on establishing laws (nomothetic) or more on establishing methods (methodological)?

The ‘analytic approach’, accompanied by a nomothetic or normative research orientation puts the emphasis on formulating general truths *in vitro* (i.e. fundamentals) and on applying relevant theoretical knowledge to a more or less ‘messy’ reality. This approach is reflected in various theories and relevant methods from information processing and mental workload measurement, to biomechanics and human force exertion limits. In contrast, the systems approach does not put the emphasis on revealing laws and on applying theoretical knowledge. It puts the emphasis on methodologies of research (or inquiry) *in vivo*, and deals as much with defining problems as it does with ‘resolving’ them. In the systems approach to HFE, fundamentals and measurement are more a function of problem definition than vice-versa. Also, theory in the systems approach tends towards formulating regularities than towards revealing general truths.

As for the second fundamental characteristic highlighted in the report, i.e. design orientation, this inescapably entails taking a distance from the positivist position. The positivist position is purely quantitative, empirical/analytic; it states and verifies facts. On the other hand, design, as an open-ended endeavour, cannot limit itself to factual knowledge. Following the design orientation proposed in the report, HFE should aim more at creating novel possibilities for action, than on diagnosing pathologies based solely on measurement and standards. Borrowing from Pierre Falzon in a discussion at the Triennial IEA congress in Maastricht (personal communication, July 2006), ‘*the HFE professional should understand his/her approach as being closer to that of an architect than that of a physician*’.

This observation is far from new; one only needs to remind oneself of the ‘ergonomics design paradox’ as expressed by Theureau and Pinsky (1984) in the mid – 1980s to fully appreciate this epistemological obstacle. They claim that ‘*to draw up proposals for the design of a future work situation, the courses of action in that future situation must be reliably known; yet they can be reliably known only when the future situation has been fully designed and set up; but then, the ergonomic contribution can concern only the next design process*’. The same problem has been expressed by Woods and Hollnagel (2006) as ‘the envisioned world problem’ or by Woods (1998) as ‘the cognitive task design paradox’; i.e. the paradox that the artefacts we design change the very assumptions on which they were designed. These authors suggest that to overcome this obstacle one must adopt an iterative, developmental approach. In the same manner the Scandinavian approach to participatory interventions addresses the same concern (Noro and Imada 1992, Jensen 1997, Haines *et al.* 2002).

In our understanding, the report, by pointing to the systems approach, inevitably suggests a gradual shift in focus from the ‘analytic approach’ of much of traditional HFE. In the same manner, the design orientation advocated, calls for a corresponding move towards a more methodological orientation in research. This raises important epistemological issues in a discipline grown mainly in the positivist tradition.

The report does not further develop the consequences of its proposal for the future of research and training in HFE. Although it identifies a ‘shortage of high-quality HFE<sup>2</sup>’, its authors seem to imply that the current state-of-

the-art of HFE knowledge and training is adequate and that this 'shortage of high-quality HFE' is mainly due to a 'shortage of enough good ones around to apply it'.

Although we accept that there is some truth to such an explanation, in our opinion it does not facilitate a progressive position. The shift to systems and design, to be operational, calls for a corresponding revision of what constitutes the core of research, education and practice in HFE.

The proposed shift to systems and design should in no way be taken as a rejection of the analytical method or of measurement and empirical verification per se. In so far as these well-established methods and techniques work well, e.g. in physical sub-systems or in partial problems, one should endorse them without hesitation. The proposed shift has to do with the philosophy of the discipline that, in our view, ought not continue to adhere to the positivist/reductionist paradigm.

In our opinion, as developments in the mother sciences (e.g. psychology, physiology, sociology, engineering) progressively enrich the normative knowledge base, the originality, added value and survival of HFE depend increasingly on the methodological focus of our discipline and the interventionist character of our practice, more than on our role as 'holders and producers of normative knowledge'. Moreover, such knowledge – even when relevant and usable – is getting ever easier to retrieve both by professionals and by end-users (e.g. through the internet).

We are perfectly aware that there are diverging views inside the HFE community concerning these important and delicate issues, and that one view does not entirely exclude another. We are also aware that the HFE community at large may be unprepared or unwilling to accept a radical redefinition of its fundamentals, education and research. Up to the present day the discipline has grown by more or less accepting a diversity of views. However, this diversity should not prevent us from considering the issue (and may prove to be an asset when change is required). The debate needs to be conducted on a greater scale than it has been up to now.

The third fundamental characteristic of HFE, as identified in the report, is that HFE focuses on two related outcomes: performance and well-being. This position also reflects the IEA 2000 definition of HFE, which states that the aim of the HFE profession is 'to optimize well-being and overall system performance'.

The report, following Wilson *et al.* (2009), acknowledges that these two outcomes interact in complex ways and that managing practical as well as ethical trade-offs are part of HFE interventions. However, elsewhere, the report returns to the more conventional view of 'joint optimisation' between performance and well-being and does not develop the issue further.

Our experience has driven us to question the unequivocal value of this traditional HFE definition. It is well known that, depending on the context, performance and well-being can be antagonistic as well as synergetic. As already stated by Alain Wisner back in 1972: '*The nature of man-machine system components is so heterogeneous that it is impossible to consolidate a unique criterion for proper functioning. Machine performance and human satisfaction may be a long way from converging in industrial reality*'. In our opinion the situation has not changed significantly since the time that this was written.

By simply maintaining the aim and distinctive aspect of the profession as the joint optimisation of human well-being and overall system performance, the report conveys a positive albeit simplistic message. We do not object that there are always opportunities for synergies or innovative ideas in any system that can be tackled with relative ease; however, such 'free lunch' is always limited in system interventions. Apart from a relatively limited number of cases in which such a synergetic joint optimisation can be clearly demonstrated, in most real world situations this aim is either infeasible or more importantly indefinable.

Often the problem lies in the time horizon, the scope or other system boundaries. Increasing performance in the short term may have negative effects on long-term well-being. Also, positive effects on a performance parameter of a particular subsystem (e.g. productivity) may negatively affect other parameters in other subsystems (e.g. safety). Indeed, 'overall' system performance is a notion of such extreme complexity that it overwhelms the capability of any single discipline. As pointed out above, if one talks about optimisation in such a complex system, one has to be clear about the time horizon, the scope and the other system boundaries that have to be considered (Wisner 1972, Marmaras and Nathanael 2005). This by itself is a task of tremendous difficulty and in most system interventions such definition stays partially implicit at best.

But it is not only the system complexity that renders the aim difficult or indefinable; in any human activity system there is also the complexity induced by human interpretation and intentionality. Human intentionality in particular, individual and collective, enters our systems, whether we acknowledge it or not, and this inevitably introduces antagonistic relations and contradictions. Conflicts and contradictions occur even inside a single human actor, e.g. fatigue vs. wage, musculoskeletal health vs. physical effort, comfort vs. protection, etc. (Wisner 1995a).

Conflicts and contradictions are inherent properties of the systems we tackle, not some mysterious side effects that threaten an otherwise harmonious totality (Nathanael *et al.* 2012).

Our understanding is that the joint pursuit of ‘system performance’ and ‘human actor well-being’ should be evoked as a general vision that recognises the complexity of the problems in need of ‘optimisation’ in any particular situation. In other words, this joint optimisation should not be taken as a scientific principle, but as a useful motto. We firmly believe that seasoned HFE practitioners will agree with the above. Indeed, indiscriminately believing that human well-being has a positive impact on system performance, without considering the complexity and the pragmatics of any particular system, is overly simplistic and, in our view, not an effective strategy for the future. HFE will not overcome the obstacle of ‘contributing towards system performance’, as indicated in the report, if as a community we do not formally acknowledge the complexity of the aim. Thus, the definition of HFE should not stay confined to the easy part of synergetic optimisation; it should pertinently point also to the tough part of design contradictions and trade-offs. We believe this is where HFE can offer unique added value. It is also our contention that the discipline is mature enough to make theoretical progress on this issue.

The uniqueness of HFE lies in its purpose (scope and object), i.e. striving to ameliorate purposeful human activity in different contexts. The term human activity can encompass all dimensions of purposeful or practical human concern: the self-sustaining, the performative, the developmental, the self-fulfilling and the communicative and socio-cultural ones. This purpose off-course needs to be further elaborated for every particular HFE endeavour, depending on the context at hand.

Properly speaking, expressing the object of HFE as ‘purposeful human activity’ could be more accurate than as ‘interaction between humans and technology’. In a similar fashion Wilson (2000) proposes the term ‘human behaviour and performance’ as the object of HFE. The interaction with the technological and the physical environment is inherent in the term activity (or in human behaviour and performance), since activity is ‘energeia’ in the Aristotelian wording, i.e. ‘being-at-work’. Activity can also accommodate the subjective component of well-being, i.e. how well-being is perceived, expressed and experienced by different individuals. According to the above view, HFE does not study people and technology in equal terms, interacting inside an indifferent environment; HFE studies what people do with technology in an environment they can partly influence and have stakes in. Therein lies one truly unique quality of HFE compared to other human - technology disciplines.

HFE professionals typically contribute to the performance of work systems not by designing better machinery but by designing artefacts that improve the performative and developmental dimensions of human activity. Subsequently, in lay situations, HFE professionals may contribute to the design of artefacts for the self-fulfilment or social dimension of human activity, as in play, or again, in educational situations, they may contribute to the design of artefacts for the developmental and self-fulfilment dimensions of human activity. Alternatively, if an intervention contributes to overall system performance, but does not affect human activity, at least in its self-sustaining dimension (e.g. health and safety), then by definition it should not be considered in the sphere of HFE.

That being said, if one is to accept purposeful human activity as the object of HFE, one should also tackle the problem of discrepancy between subjective and objective descriptions of activity, or in other words, the stance of the HFE specialist regarding the autonomy of the human actor. This issue however cannot be tackled in the short space of the present paper (for a comprehensive discussion see Theureau (2002) on ‘the primacy of the intrinsic’).

To conclude on the issue of how we understand our discipline, we would express the three fundamental characteristics of HFE pointed out in the report as follows: HFE’s *object is purposeful human activity*, its *scope is pragmatic*, i.e. to contribute to the design of artefacts or more generally to influence reality for practical purposes, and its *approach is systemic*.

### Concluding remarks

Overall, the report focuses more on the external environment than on the internals of HFE. For example, in Section 4 ‘The value of HFE for stakeholders’, there is a long and diverse list of benefits that different stakeholders may gain from applying HFE, where the word ‘better’ as well as other positive adjectives, e.g. ‘improved’, ‘higher’, ‘more’, ‘greater’, account for a significant percentage of the word count in the section. This reflects a ‘silver bullet’ type rhetoric, i.e. by somehow ‘applying’ HFE, one gets better results than by not applying it. This rhetoric seems self-assertive, possibly problematic and of questionable help (as any such rhetoric) in promoting HFE thinking and methods in systems design.

We honestly and sincerely pose the question: is it that the ‘system deciders’ have not discovered us (HFE professionals) yet, or is it that the ‘silver bullet’ thinking is missing something? Is it that there are not enough

high-quality professionals around, or is it that HFE research and training are still lacking in what industry at large demands?

Obviously the questions above are not mutually exclusive. However, to be progressive, HFE as a discipline needs to formulate an internal discussion that is more critical than self-assertive. Again, we emphasise that it is most probably our preconceptions that need to be revised and not so our marketing.

It may be misleading to advocate indiscriminately that HFE offers 'better results' than other disciplines. HFE and particularly high-quality HFE should employ original thinking and methods to produce empirical evidence concerning human activity in its context and facilitate better decision-making. HFE should also formally acknowledge that in system design it deals with contradictions and trade-offs, its role being to advocate the human activity perspective and to protect systems from important human related pitfalls.

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### Notes

1. Indeed it often sounds odd to people in industry when we market as 'ergonomics' both the user testing of an e-banking application and the protection programme against a harmful chemical agent.
2. High-quality HFE is defined in the report as the knowledge or ability to take into consideration all three core elements of HFE when defining problems and formulating solutions, meaning a systems approach, design orientation and optimisation of system performance and human well-being.

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