BEYOND BOX TICKING – THE ROLE OF HUMAN FACTORS IN DESIGN

Daniel P Jenkins

DCA Design International, Warwick, UK

In many industries, human factors is now a mandatory part of the product development process. Regardless of whether this stems from a regulatory or contractual requirement, it has played a significant role in the recruitment of human factors' specialists into project teams, and the adoption of their tools and techniques. The integration of human factors in a project team, should lead to safer and more productive systems. However, this 'free pass' on to the development team, has the potential to reduce the role of the human factors' specialist to one of a 'box-ticking' exercise. This paper explores the importance of communicating the value of human factors, and discusses how the unique skills and tools held by human factors' specialists can allow them to assume a pivotal role.

Introduction

There is a commonly held perception that the role of ergonomics' and human factors' specialists (for convenience, human factors' specialists hereafter), is to supplement a design team and provide advice. For many, the role of human factors' specialists working in consultancies and in-house development teams is often perceived as providing upfront input into the development of design specification, and the subsequent acceptance sign-off. In this perceived view, there are clear points in the design process where the human factors' specialist needs to be consulted. They support the development of a product specification by providing key information, such as acceptable pushing or turning forces, and optimal handle heights and sizes (typically relying on standards and key texts, such as Pheasant and Haselgrave; 2006). While, in the later stages of the design process, the human factors' specialist is called upon once more to assess the compliance of a concept, or range of concepts, against this specification. This

often involves testing the push forces required, compliance against usability checklists (e.g. Neilsen & Milich, 1990), or acceptance testing with end-users.

There are, undoubtedly, instances where the relationship just described is largely accurate. Indeed, many international standards (e.g. BS EN 62366:2008) and guidelines provide graphical examples of a classic design cycle that is annotated to show: what information is required from human factors' specialists, at which stages of the project they should perform evaluations, and the kind of documentation that should be created. However, somewhat reassuringly, for many who work as practitioners in design consultancies, or in-house design teams, this way of working will seem at least over-simplified, but more likely antiquated or simply unfamiliar.

One possible reason why the role of the human factors' specialist is often perceived in this manner lies in the regulatory requirements for human factors' integration. This, often legal, or sometimes contractual, requirement is captured and explained in human factors' integration plans (HFIPs). These plans provide a description to the project team of the human factors' specialist's role. They also form an important part of documenting the process for regulators and auditors. As such, human factors' specialists are required to write these plans, conduct assessments, and produce reports.

Clearly, the mandatory requirement for human factors involvement is welcome, and has had a significant influence on both safety and productivity, not to mention the growth of the discipline. However, not having to justify explicitly one's role, or the value that the consideration of human factors can bring to a project, can also be considered as a hindrance. Particularly in gaining acceptance and influencing key project decisions. When considered in this way, there is the very real risk that human factors' integration becomes a tick-box exercise. While mandated human factors' involvement may lead to positive impacts on the design, these are often viewed as a convenient side effect of the regulatory process, rather than an objective.

Regardless of whether the industry in question is regulated or not, most would agree that good human factors involves going beyond 'box-ticking'. As a discipline, we have a wide range of skills and tools that are either designed to support design and innovation or can be readily repurposed to do so.

Skills

Those trained in human factors typically come armed with a number of skills that are extremely valuable in the process of designing products. These include capturing and filtering salient information from real-world situations (e.g. ethnography), eliciting stakeholders needs, values and mental models (e.g. interviewing), and building and testing hypotheses (e.g. experimental design). These kinds of skills are required throughout the design process. However, they

are particularly useful at the start, in helping to define the purpose of a product, the constraints imposed by multiple stakeholders and the required context of use.

When designing consumer goods such as children's toothbrushes, this may involve visiting users in their home and observing not only the act of tooth brushing, but also how tooth brushing fits into their routine. Interviews may be conducted with experts such as dentists, as well users and stakeholders (parents). Experimental design may include the development and testing of a range of concepts.

Also, as systems thinkers, human factors' specialists often hold a unique view of the systems that they support. While many of the engineers and designers in a project team will be required to specialise in one aspect of a product, human factors experts are, more often than not, required to think of the system in its entirety. Because human factors' specialists hold this unique macro view, it is not uncommon for them to be called upon to provide high-level explanations of larger projects to visitors. The ability to think of the wider system that a product inhabits is of clear value. The growth of the service design industry is testament to this. This systems-level consideration often allows a human factors' specialist to define the purpose of a system, as well as important metrics for assessing its performance.

Tools

The choice of tools will be largely dependent on the type of project. Where incremental improvement of a product is required, for example developing the next generation of product using the same manufacturing processes, descriptive and prescriptive tools are normally appropriate. Tools such as task analysis (Annett et al, 1971; Stanton, 2006) can be used to explore current practice, either idealised or observed. These simple diagrams often prove to be valuable resources for project teams, forming a common language. Moreover, they can encourage the team to think beyond the primary task to the steps either side of a traditional model. For example, models may be extended to consider the purchase journey associated with a product or its disposal.

There are many compatible tools that can be used to identify opportunities for incremental improvement. Typically, a different tool is used for each metric, for example, safety (e.g. TRACEr Shorrock & Kirwan, 2002; HEART, Williams, 1986; CREAM, Hollnagel, 1998), efficiency (e.g. critical path analysis), efficacy, intuitiveness, manual handling (e.g. REBA, Hignett & McAtamney 2000; MAC, HSE, 2004), and resilience (e.g. FRAM, Hollnagel 2012). A task analysis model can be used as a common reference point to tie these analyses together. To the initiated, this impact of these models is often under-estimated. However, engineers and project managers are often looking to inform evidence-based decision-making. As such, they are, more often than not, very receptive to tools that link performance changes of physical components to metrics that are more tangible to users and stakeholders.

Where the objective of a product is less well-defined, or there is scope to revisit the current proposition, more formative tools such as cognitive work analysis (Rasmussen et al 1994; Vicente, 1999; Jenkins et al, 2009) can be used to explore the constraints that shape behaviour. Alongside design strategists, human factors' specialists can use these tools to form the basis of defining what a product should be, and defining how they should be designed to support known and emergent user needs. These tools are extremely useful in markets where known needs (those that can be captured by simply asking a user what they would like from a product) have been met, but there remains scope to improve performance.

The exact choice of tools and techniques will be heavily influenced by the product, and the domain that is being designed for. Notable constraints that shape an approach include restrictions on manufacture, as well as the availability of time and resources. The tools used as examples above, each have their relative strengths and weaknesses, and there are many that could be used in their place (the latest human factors methods book covers 107 methods; Stanton et al, 2013). The purpose of this paper is not to advocate specific tools, nor is it to prescribe a new technique or framework, but rather to encourage a philosophy that, to many, will be simply considered best practice. The examples above are intended to highlight how a wide range of tools and techniques can be combined to not only describe work situations, but also to quantify their performance and identify opportunities for improvement. This last point is of critical importance in product design, as analyses that do not identify ways of improving a product are of limited value.

As researchers, we can often become overly concerned with the reliability and validity of the approaches we use. However, in product design, absolute values of human performance are typically far less interesting than the relative differences between concepts or between new and legacy products. Clearly, there are times when validity is imperative, such as when marketing claims are made. However, for supporting evidence-based decision-making, tools that can identify gross differences between concepts are adequate.

Role

Human factors' specialists are using some of the skills and tools discussed to gain valuable insights into products and contribute in the innovation process. This up-front emphasis on defining the product purpose and values, as well as direct input into the ideation process, represents a clear step-change in role. As such, these refined roles draw a stark contrast with the perceptions described at the start of this paper of individuals who simply set specification points and test them.

As a direct result of these insights and inputs, human factors' specialists are now commonly taking fully integrated roles in the design team and are becoming involved in all key decisions throughout the design process, regardless of their

pay grade. Furthermore, it is not uncommon for them to take senior roles in design teams. To put it simply, in many organisations, the idea of human factors experts working as a bolt-on resource is a thing of the past.

Conclusions

In summary, regulatory requirements for human factors' integrations have increased awareness of the discipline in many industries. Even in non-regulated domains, clients and stakeholders now come with preconceived views of what human factors' specialists do. The importance of ergonomics is often largely understood from a theoretical perspective. However, the direct value to the project is, typically, less clear.

In many organisations, the role of the human factors' specialist has evolved to leverage their unique skills and tools. They are now assuming more strategic roles, helping to define the purpose of products, and providing an important part of the evaluative process.

Looking to the future, it is important that as a discipline, human factors' specialists continue to innovate and keep pace with the changes in product development and market requirements. The existing core skill and tool set is largely fit for purpose. However, continual innovation is needed to ensure that these tools are used effectively and efficiently to provide demonstrable value to the design process. The exact mix of tools and techniques, along with the fidelity of the analysis, will need to be specific to the project at hand. This will be influenced by the size and scale of the project, its place in the design cycle, and the size and experience of the human factors team.

Fortuitously, human factors specialists come armed with a suite of tools that allow them to observe the environments that they work in and identify how the organisations, as well as the products and systems they are developing, can be improved. Through an evidence-based approach to design, based on quantifying change, we can move from the rhetoric of evangelising the philosophy of user centred design to letting the evidence sell the value of the proposed change and, in turn, the value of human factors.

Furthermore, an evidence based approach often acts as a useful leveller; the data often speaks for itself giving junior members of a project team a powerful voice. Ultimately, though, if human factors' specialists are to have a positive impact on product performance through design, they not only need a seat at the decision-making table, but also need influence. In order to assume key roles in the design team, it is imperative that human factors' specialists communicate their value and influence on improving the quality of design - irrespective of whether or not they are mandated to be involved.

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