

# **A theoretical reflection on the practice of designing for usability**

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## **Abstract**

A three-year project to apply concepts of usability to workplaces has raised philosophical issues that question the pre-dominant ways of briefing, design and evaluation. Standard methods of assessing usability, in terms of efficiency, effectiveness and satisfaction are criticised and important dimensions for evaluating user experience, including context, culture and situation, are proposed. The paper contrasts the predominant rationalist perspective, which argues that usability lies in the properties of the product, with a pragmatist view that suggests the need to understand the user experience of buildings. The paper argues for the definition of problems in the user context, and specification of outcomes in terms of changes in behaviour, rather than in terms of function.

## **Keywords**

Usability, theory, pragmatism, workplaces

## **Background and problem field**

This paper is a theoretical reflection on the *concept of usability*. Over the past three years an international group of researchers and practitioners have conducted a series of five case studies to investigate the concepts and meaning of usability.<sup>1</sup> The common point of departure of the participants has been that, as a mixed group of practitioners and academics, all have been working with users of workplaces and work environments.

The work focuses on the outcomes of design and seeks to understand why, despite the involvement of experienced managers and skilled designers of workplaces, and the use extensive research in design methods and briefing methods, post-occupancy studies and evaluation methods, too often the resulting artefacts, cannot be used efficiently and effectively by the users in real situations.

Some may question the research evidence for this statement. However, it is possible to investigate any number of completed buildings; even those designed by the most reputable designers and find that, by asking the users, many of these buildings fail to perform satisfactorily.

To use one prominent example, Robert Gutman has conducted a number of interviews [1] with architects and users and has given us a good example in his article "*Human Nature in Architectural Theory: The Example of Louis Kahn*". Gutman discusses one of Kahn's principal works, the Richards Research Laboratories at the University of Pennsylvania. He quotes a letter from the Director of the laboratories saying:

'Dear Dr. Gutman:

I suspect that nowhere in the history of 20<sup>th</sup> century architecture could one find a better example of an edifice which, over the same interval of time, has:

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<sup>1</sup> Laboratoire Espace de Travail, La Villette, Paris, France , Norwegian University of Science and Technology (NTNU), Trondheim, Norway, Chalmers University of Technology, Gothenburg, Sweden, University of Salford, Greater Manchester, UK, VTT, Transport and Buildings, Helsinki, Finland

- i) enhanced the stature of its creator in the eyes of his profession (students of architecture swarm around this building like Bees at a rock festival), and
- ii) seriously impeded the progress of medical science, because of its gross inadequacies from the viewpoint of those who have to use it.

Gutman reflects: *“From the perspective of someone situated outside the world of architects, it may be surprising that the Richards building has not shaken the architectural community’s attachment to the building, or diminished in any way their reverence for Louis Kahn.”* [2]

Hinnersson has recently presented a thesis where she reports a number of interviews and questionnaire results from Swedish professionals in corporate real estate, construction management, project management and designers and users of large corporate real estate premises.[3] The findings agree that the results arrived at, often do not meet the expectations for usability set up in the brief. They are anxious to find out why it is so.

### **A philosophical approach to the problem**

The paper suggests that one reason for the discrepancy between the intentions of a project and the actual results, from a user perspective, can be found in philosophical differences. It is argued that the predominant ways of thinking about and providing facilities and built environment solutions, leads us in the wrong direction when we look at reality from a user’s perspective.

The current philosophical paradigm of design, taken as a tool to arrive at true result in terms of usability it could be said, with Popper’s reasoning, that the current philosophical paradigm is not true for its purpose. Time after time, reality has falsified the ability of current thinking to help us in arriving at usable solutions, which according to Popper proves that it is false.

This paper elaborates this criticism and also investigates an alternative paradigm that might be more potent from a usability perspective. It suggests that current thinking in design and provision of workplaces is dominated by a mainly rationalist way of thinking. The paper investigates whether pragmatism, offers an alternative way of reasoning.

Current design thinking is, naturally enough, strongly focused on the artefacts that we design. The functions of those artefacts and their overall functionality are what we are aiming at.

### **Current thinking**

The meaning of functionality, and hence the meaning of functions, are ambiguous. A thorough investigation of the different definitions of functionality has been carried out by Warell [4]. He concludes that all perspectives on functionality agree that the concept is strongly connected to the reason why the product should be designed, i.e. the purpose of the product. He also notes that talking about functional aspects of an artefact makes it possible to address its properties in an abstract way, without choosing definitive solutions.

Warell defines function as: *‘what a product or an element of a product actively or passively does in order to contribute to a purpose, by delivering an effect. A function is intended or incidental.’* He continues: *“the functionality of a product is the combination of all its effects, properties, and their behaviour, that contribute to making the product useful for an intended purpose”.*

Discussion and definition of the preferred functions of an artefact is therefore important in all kinds of design. The paper offers a third, possibly more obvious, aspect of the function of an

artefact and hence its functionality, which are the result of the physical properties given to a chosen artefact that, through the problem definition and analysis, will meet requirements.

*This means that conventional design processes delimit function to those aspects of usability that arise from the properties given to the chosen artefact. In turn this means that aspects of usability that are not a result of properties of the artefact, or properties that could not be foreseen at the early conceptual stages of the process, will not be fulfilled. Despite this, most evaluations of finished solutions are made by observing the artefact itself or by testing the performance of those functionalities that were identified in the brief.*

Research on the evaluation of buildings is now widespread and includes valuable, international contributions. The “Serviceability” tools created by Davis et al [5] are one of the most widespread practical and theoretical vehicles to evaluate building performance. Davis distinguishes between *performance* and *serviceability* [6] and argues that: ‘serviceability is about whether a building or facility is *capable* of performing as required. /.../ (whereas) performance means actual behaviour in service at a given moment.’

The characteristics of the concept serviceability, as it is defined by Davis et al, and adopted by most students of the field, is that serviceability and hence performance are causally tied to functionality. In Davis’ reasoning, serviceability is synonymous to usability in the meaning it has in ISO standards [7].

Another important contributor to the field is Wolfgang Preiser who is the foremost figure in developing Post Occupancy Evaluation (POE) techniques [8]. POE is a technique strongly tied to performance and is, traditionally, a technique that is used after a building is in use. In recent writing however, Preiser has identified different types of POE – indicative, investigative and diagnostic [9].

### **Meaning of Usability and reflection of current thinking**

The ISO 9241-11 defines Usability as: ‘The extent to which a product can be used by specified users to achieve specified goals with *effectiveness*, *efficiency* and *satisfaction* in a specified context of use’ (our italics).

The definition identifies a number of important issues that should be considered when considering the usability of a solution. Usability should be addressed to ‘*specified users to achieve specified goals*’. This in itself represents a problem as, from a rationalistic perspective, these goals and users have to be identified and specified, in advance in the brief. This may have been possible, but is not likely to be so, even in earlier days when pace of change was less rapid than it is today. The problem is that, even if we should manage to collect all data needed in the conceptual stage of a design situation and hence be able to specify the users and goals, they are likely to be out of date before the design of the artefact has been fully developed. Research also shows that, in many cases, the outcome of design does not live up to the goals of usability specified in the brief [3].

Philosophically, it is not surprising that a rationalist attitude to design does not deliver true usability. The Nobel laureate and design theorist Herbert Simon explains that it is not possible to depend on a rational attitude in design, as it is not possible to collect all the data needed to arrive at a rational, i.e. optimal solution. Secondly, he argues that, if it were possible to collect, that human intellectual properties would not be able to process all that data, to arrive at a rational solution. Thirdly, Simon questions the actual concept of optimal solutions. He argues that most problem settings, especially those connected to human behaviour, does not have any optimal solutions, just satisfying ones.[10] This has led us design theorist Peter Rowe to suggest categorisation of design problems into one of three types ‘*well-defined, ill-defined and wicked problems*’ [11].

**Well-defined problems** are those where the goals are defined and the possible means of achieving them are understood. The problem is a matter of finding the correct application of the means to satisfy the goals.

**Ill-defined problems** begin with both the goals and the means for achieving them unknown in their entirety. Most architecture is of this type of problem. The design exercise requires a formulation of the task in hand to identify the goals which need to be satisfied. The problem-solving task then involves search for appropriate means to accomplish the goals identified.

**Wicked problems** are a subclass of ill-defined problems for which the difficulty of finding a problem solution is increased due to the lack of an explicit basis for termination. Additional questions can always be asked of the problem which causes continual reformulation of the task. Different formulations imply different solutions. The result of this indeterminacy is that solutions are always ambiguous, being neither correct nor incorrect." /Rowe/

Following Simon, if it is not possible to find true optimal solutions to the kind of problems we are confronted with in design, we must conclude that these problems are either ill-defined or wicked. If we still believe that it is possible to achieve usability through rationalistic briefing methods we can go to another rationalist,

Further to the rationalist perspective, Carl Popper argues that a statement cannot be *verified* by a successful outcome, but *falsified* by an outcome that does not deliver what was proposed by the theory [12]. Most users of designed artefacts can testify that the outcome does not always deliver the expected usability by giving an artefact certain functional properties.

Another preferred, but little practised paradigm of engineering knowledge and design was proposed by Donald Schön as a technical rational way of thinking [13]. Technical rationalists argue that, to a large extent, we have all the knowledge we need from theoretical investigation and reasoning in research to know, in advance, the properties to give to an artefact to achieve functionality and hence a usable product.

From this perspective, the intentions and visions that are defined in the brief for the product are definitive and of paramount importance to the outcome, which is defined as the product itself. The validation of the intentions is to be found in the properties of the product. If all the properties of the product are connected to identified and intended functions in a certain context, the goals are achieved. This means, that the product is truly usable if it has all the functions that are intended in the brief for the product. This way of separating the briefing process from the actual design process, and of dealing with it in a static way, is advocated by the American design theorist William Peña [14] and has still a strong impact on the design and project management praxis. [3,15]

### **Fragmentation of knowledge and true outcome of design**

In rationalist thinking the question of truth is essential. The pragmatic theorist William James says: 'Truth means, as a matter of course, agreement, correspondence, of idea and fact (p. 198), ....' So far rationalism and pragmatism are in agreement, but James continues: '....but what do agreement, correspondence, mean?' With rationalism they mean 'a static, inert relation,' which is so ultimate that of it nothing more can be said' [16].

Truth in rationalism is something logically derived from intellectual reasoning rather than from experience. It might be strange to some readers to accept that professionals, involved in such practically-oriented activities as space planning and design, should lean on a

philosophical paradigm that sets intellectual reasoning before senses beliefs and experiences.

To understand this we must return to Donald Schön's writing on how professionals think. He describes the concept of technical rationality, as a kind of rationalism that deals with the inherited knowledge in the subject area as if they were true intellectual constructs, rather than a mixture of intellectual intuitive and deductive knowledge and knowledge derived from experiences, which they probably are. But object focused thinking limits usability to those aspects that can be met by the properties actually given to the object. It also limits the solution to real life problems to those that can be met from within our respective professional domains.

Schön elaborates this and says that the technical rational professional has two ways of dealing with problems that fall outside his/her professional knowledge. One way is to leave it to someone else, and the other way is to reduce the often ill-defined or wicked problems to a set of well-defined problems where at least some of them fit into his/her professional domain.

This is the core problem in rationalist design practice. Within a particular professional domain goals are defined that can be achieved by designing artefacts in our area of competence. If we do a good job we might arrive at results that satisfy the goals we had for the project and also in terms of effect on our lives as users. Again Schön discusses this and says that the problem definition is crucial to the technical rational designer as it is the foundation for success. If the problem definition is not properly reduced to something the professional can master, the design project might fail.

Simon suggests that design has to do with changing a situation that is not desired into a more desired one [10]. The pragmatist philosopher, John Dewey is very clear that the *meaning* of an object, or an idea, is different from the object or idea itself and must not be confused with them [17]. The *meanings* of an object consist in 'the practical reactions objects exact of us or impose upon us.' By *practical* he means '...the future responses which an object requires of us or commits us to.' It is only when the effect of an object corresponds with the idea of the effect of the object that the idea/intention is true.

So, according to Dewey's pragmatism, the idea, or the brief in building design, is a tool to effect changes in the designed building, and the building is the tool to effect the way the building might be used for its present and future intention. The important conclusion of this is that the only thing that matters in design, from the point of view of the users, is the effects that are imposed on our lives by the ideas or objects of design. It should not have to be said, but as architects often react to this statement, it has to be stated that the aesthetic and artistic qualities, as well as ethical qualities are included in the effects that are imposed on, and important to, the users.

### **Effectiveness of design solutions**

To return to the standard definition of Usability, it suggests that efficiency, effectiveness and satisfaction should be proven in a *specified context of use* (our italics). Again, the context that the designed artefact will be acting in must be foreseen, as it will change with the timing of use.

A brief for a building might cover all the aspects of functionality that would enable the building to be usable at the time of initial use. The building might even be *designed* in such a way that it would be perfectly usable for its purpose at the time it is finished. It is however more difficult to foresee future changes in use that have to be met in the briefing and designing of

the building, even if skilled professionals in the area have the tools and methods available to master these problems.

Let us take an example: A university building is defined and designed, as most still are, from a traditional pedagogical perspective, where the major mode of communication is one way – from teacher to students. The professor teaches the students through lectures and the students learn through listening to the wisdom of the professor. This teaching pedagogy is built on a specific view of knowledge and calls for a special type of university buildings.

There is long experience of briefing, design and use of such buildings and they mostly perform quite well for their intended purpose. However, a change in the pedagogical paradigm to, for example, a *learning pedagogy* where the focus is on students willingness and ability to search for knowledge through dialogue with each other and the professors, more than on the one way communication of wisdom from teacher to student, requires quite different university premises. What is still more serious is that the traditional teaching environment would be quite “useless” for this new pedagogy.

It is not a question of ‘was it wrong to design a building that did not prove to be sustainable in use?’, or ‘should it have been possible to foresee the development of new pedagogy?’ and hence to build that possibility into the brief. *The major question is however - ‘is possible to cater for future usability based on a rationalistic view of design?’*, as we dominantly do today.

### **Satisfactory design solutions**

The third aspect of usability, after efficiency and effectiveness, is satisfaction. In traditional thinking this is interpreted as satisfaction with the properties of the artefact. Because of that satisfaction is also evaluated by checking the properties of the artefact.

In pragmatist philosophy, true satisfaction does not lie in the properties of the artefact itself, but in the way the artefact imposes on our lives. Those who trust solid practical evidence, more than philosophical constructs, have to look at experience of what is satisfactory in design. The series of case studies conducted in the Usability project found that the satisfaction of a solution has to do with more than the properties of the artefact.

For example, it was found that the ownership of the solution is important. Ownership can be promoted by user participation in the design process, as was shown in the British and Swedish cases. The Swedish case also found that trust between the building client, user organisation and the users had a strong impact on satisfaction even when other aspects of the changing situation was both cumbersome and frightening to the users. The Swedish consultant firm Temaplan has done extensive work on customer satisfaction in both public and private sector and has found that the physical properties of the premises are not the most effective way of achieving customer satisfaction.

Participation and involvement are more potent ways. The standard of the premises are however not unimportant. The Norwegian case showed that an extremely high standard of environment might compensate for a lack of participation from the users’. It was also obvious that a satisfactory standard in Scandinavia is higher than the equivalent standard in the UK. On the other hand, parallel studies done by Building Use Studies from UK in connection with the case study, showed that, on average, the Norwegian users were more satisfied with their standard than the UK users were with the UK standard of workplaces.

These cases indicate that, although perceptions are affected by the quality of the object, other factors impact on satisfaction, even if the standard of the solution is less extravagant. It

was also clear that user satisfaction will also differ according to cultural differences, context, expectations and the actual situation of use.

## Conclusions

Perhaps an example from another area will provide further clarification. In Sweden, a cross-disciplinary research group was formed by the government to find out if organically produced food has a higher quality than normally produced food. Researchers cannot find any absolute evidence that it is so. In some cases it is, in some cases not. It is also questioned whether organically produced food is better for the environment and for animals in the production process. Also in this matter the results are ambiguous. In the Swedish context, the reason for this is that traditional food production has adopted many methods and philosophies from organic production that has resulted in high quality food to a normal price.

From a rationalist point of view, where we believe usability lies in the properties of the product, this would be a problem for those who produce organic food. But, those who buy organic food do not buy it only for its product properties and certainly not because of the price. For them the production process, the participation in something larger than buying food, their belief in doing something good for the future etc. is a part of it. From this point of view normally produced food can hardly be usable to these customers, despite price, taste or looks.

ISO defines Usability as: "the extent to which a product can be used by specified users to achieve specified goals with *effectiveness*, *efficiency* and *satisfaction* in a specified context of use" (our italics).

Current, predominant ways of thinking are not effective in arriving at usable solutions for work environments because problem definitions and evaluation of outcomes are not made from the perspective of users, but rather dictated by the structure and thinking of the professions that deliver the solutions.

Fragmentation of the professions presents obstacles to arriving at effective solutions, leading to definition of the problems and of those that deliver the solutions. In use, facilities are not fragmented in the same way as in their creation. You get the solution that lies within the domain of those that deliver the solutions. You might get a perfect building, even if a building is not the most effective solution of the problem.

Evaluation of effectiveness is strongly tied to the ability of being usable, as it interpreted in the visions of the project, than it is tied to the actual user situation. A solution can be perfectly usable in a theoretical situation but that is not the situation of actual use.

Efficiency is often well catered for in most design situations, but an efficient solution is not usable if it is not the most effective solution.

Satisfaction is the most difficult aspect for traditional thinking to respond to. Satisfaction may be achieved, to a certain degree, by effective and efficient solutions. A solution is however not usable, from a pragmatist perspective, if it is not used. The reason a solution, that has all the functional properties that could be imagined, is not used might lie in the actual design process, in social and psychological relations, in cultural aspects or else in the situation of problem definition, design, completion or use.

This paper suggests that a pragmatist way of thinking is the appropriate point of departure for creating a usable solution. By a pragmatist way of thinking we mean that usability is proved

when, and only when, the solution contains artefacts that impose on us and allow us a behaviour that is a desired change from a situation that is not desired. In practice this means we have to define the problem in the user context, define the outcomes in terms of desired changes in behaviour, rather than the use of artefacts, choose strategies from effectiveness and sustainability of the use and define the rules for the creation from a user satisfaction point of departure rather than out of efficiency of delivering solutions.

This line of reasoning is however in its creation and will and should be questioned in all its parts. In that way we believe that something sustainable and useful will emerge. It is so far only an intellectual construct that has to be proven true in reality. However, if it in any way has an impact on our design behaviour, in such a way that we can change our design process, and hence have an impact on the design itself, it may promote the improved usability of workplaces in the future.

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