

A New Approach to Interaction Design of ICT Systems as a Special Category of ill-defined Problems

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Abstract—A well-defined problem is one in which the start-state of the problem, its goal-state, the available operators and the constraints upon operator selection (i.e. the rules that define legal moves) are known in advance. [10] However, ICT design is all about solving ill-defined problems which lacks the above traits. Things become more complex in case of designing of visual interactions and particularly digital interfaces. Digital interaction is a more cognitively demanding. Designing interactive digital products is therefore a complex process as it involves detailed understanding of user's mental models. This paper proposes to look at the interaction design for ICT systems as a special case of ill-defined problems where the design process can neither be fully constraint free nor truly constrained. There are artistic and engineering approaches to the ICT systems which need to find common ground such that the design process could be institutionalized in modern corporate design houses. Towards this goal, this paper proposes a new method based on problem identification for ICT interaction design which includes both artistic and engineering approaches in one flow.

1. INTRODUCTION

One of the way the human brain works is by sensing information, analyzing the information to give it a meaning and respond accordingly. As the brain is continuously receiving signals and analyzing the situations, it is also processing the importance of these information. [8] The brain decides which information needs to pay attention and discards rest of them. The analysis phase where struggle to make meanings of the situations is cognitively demanding process. In the attempt to create desirable environments, human brains try to reduce complexity, to establish control, by making things simpler. [2, 3, 6, 9] Times at which the brain finds hard to do so can be considered as problematic situations. This commences the process of structurally analyzing the situations or process of problem solving. Enough literature is available which tried to explain the process of problem solving [1, 4, 11, 7]. Jonassen argues that "Problem solving requires the mental representation of the situation in the world. That is, human problem solvers construct a mental representation (or mental model) of the problem, known as the problem space" [4,9]

2. WELL DEFINED AND ILL-DEFINED PROBLEMS

The specification of components of a problem space marks the beginnings of the analogy between well-defined and ill-defined problems. [11] There has been different criteria of differences between well-defined and ill-defined problems. Jonassen [5] described the range of problem solving on the basis of instructional design requirements by distinguishing between well-structured and ill structured problems. [8] Simon (1973) described ill-defined problems as those that are more complex, have less specific criteria for knowing when the problem is solved, and do not supply all the information required for solution. The distinction between ill- and well-defined problems is based on the amount of information guiding the search of solution given in the task environment. Pretz, 2003 distinguishes the two on the basis of routine or algorithm to reach a guaranteed solution. He further argues that ill-defined problems typically have multiple ways to solve the tasks. This means that in an ill-defined problem, the goal state and the appropriate method to reach that goal are not clear. The literature helps us to point out different properties of well-defined and ill-defined problems

Well defined problems:

- Problems elements are known.
- Methods to arrive at solutions are known.
- Have knowable, comprehensible solutions where the relationship between decision choices and all problem states is known or probabilistic [12]

Ill-defined problems:

- Problem elements that are unknown or not known with any degree of confidence [12]
- Can have multiple solutions, solution paths, or no solutions at all [13]

- Possess multiple criteria for evaluating solutions, so there is uncertainty about which concepts, rules, and principles are necessary for the solution and how they are organized [4]

3. DESIGN AS ILL-DEFINED PROBLEM

Design problems are among the most complex and ill-structured kinds of problems that are encountered in practice. Researchers [11] have argued design problems be as ill-defined as they possess similar properties like ambiguous specification of goals, no resolute solution path, and it requires knowledge from different domains. Be it any product or service, design required general as well as domain specific schemas. "Goel and Pirolli (1989) articulated the character characteristics of design problems, including many degrees of freedom in the problem statement, which consists only of goals and intentions, limited or delayed feedback from the world, artifacts as outputs that must function independently of the designer, and answers that tend to be neither right nor wrong, only better or worse. The importance of an artifact as evidence of problem solving and the lack of dear standards for evaluating solutions are what make design problems so ill-structured." [4] Various design philosophers and practitioners have devised models for process of design. However, it is hard to argue on the authenticity of any particular model.

Arguments have been made to call the process as iterative as it involves cyclic process of synthesis, analysis and validation. Hence, the design process cannot ever guarantee 'the solution' for any problem. The distinction between various solutions that emerge in a design process can be made on certain parameters which too are decided by the designer on the basis of available resources. The analogy between structured, no structured and ill structured problems can be further explained by different knowledge domains. Engineering problems are said to be well structured as they have all the properties of it. Engineering or arithmetic problems have structured approach for solutions.

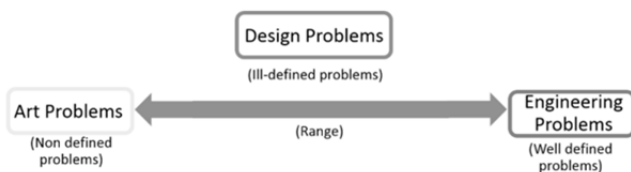


Fig. 1

On the other hand we have subjects like arts which are highly creative and does not have any approach. In between these two lie design problems which have some traits of engineering and some of arts. Now depending on various factors (still need to be explored) any problem can be said to be 'art side' or 'engineering side.' But problems will neither be fully artistic not fully engineering, problems will always lie somewhere in middle of this broad range.

4. INTERACTION DESIGN IN ICT (INFORMATION AND COMMUNICATION TECHNOLOGY) AS SPECIAL TYPE OF ILL-DEFINED PROBLEMS

Through the nature, design solutions are not domain bounded. They can range from any solid product to abstract systems design. When design solutions are projected by physical or virtual product, the designers need to ensure that the users must understand the product in order to get the best of it. Sometimes, the product designed to solve a problem is conceived as something else by the user or the user is unable to understand how to use the product, which doesn't solves the problem. The complexity of these issues in design solutions increases when the designed product is cognitively more demanding.

Advancements in Information and communication technology has made it easier to obtain and deliver huge chunks of information at great distances. Designers have extensively used ICT as mode of providing various design solutions in form of web pages, interactive portals, mobile applications, information kiosks etc. These design solutions come under the category of interactive products as mostly work through the process of demanding input from the user in order to perform action. This is mostly where the problem with these products lies. The user need to have a clear idea of what input is required in order to get things done.

The designer when designs the interactive space expects the user to use it in the same fashion. But the mental model of the designer and the user can be different and the user might not perceive the designed solution as the designer expected (Norman 1983). In order to solve issues like these, there is a need to deeply understand the user and his behavior. To understand the user and to predict the actions of users when any new information is presented, we require studies of human behavior, psychology of human brain, how people perceive information, human decision making process etc. Dealing with these vast number of attributes or subjects might lead to design complexity.

Design Complexity: Erik Stolterman [15] defines design complexity "as the complexity a designer experiences when faced with a design situation". Designers have freedom to look for the sources of inspiration and as well as subjects that relate to the understanding of the solutions he creates. "Facing such "infinite" information sources might lead a designer (even an experienced one) to experience an overwhelming design complexity...The designer has to make all kinds of decisions and judgments, such as, how to frame the situation, who to listen to, what to pay attention to, what to dismiss, and how to explore, extract, recognize, and chose useful information from all of these potential sources. An inexperienced designer might suffer from "design paralysis" when confronted with such endless opportunities." [15]

5. WHERE DO INTERACTION DESIGN PROBLEMS LIE

Design solutions through ICT requires deep understanding of the user. As discussed earlier, the designer must have knowledge of various subjects like visual ergonomics, emotional theory, decision making etc. These subjects allows a designer to make crucial decisions in design. On the other hand, in design, creativity is another very important aspect in design solutions. It is the job of a designer to figure out creative ways to solve the problem. The creative space for a designer therefore in interaction design case faces serious challenges as the attributes to play with are much limited. In interaction design solutions the designer has less bandwidth to use his creativity according to him. Any change in the design solution must be valid and tested on the users in order to get the expected results. Hence, the kind of flexibility a designer have while figuring out solutions such as grass cutting tool or a science kit for school children is much more than in designing mobile applications for a farmer. It forms a basis for determining the position of interaction design problems for ICT in the range of ill-defined problems.

By determining the type of problem we are trying to solve it becomes easier for a designer to narrow down on the research areas required for the respective solutions. On the distinction between art problems and engineering problems, interaction design problems lie mostly towards engineering side from the fact that the creative decisions provided in solutions have some scientific basis.

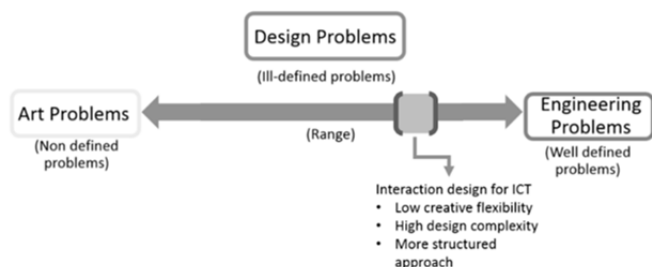


Fig. 2

6. CONCLUSION

This paper tried to explain the existing analogy of problems (defined, non-defined and ill-defined) through subject oriented approach taking engineering, design and arts as examples of well defined, undefined and ill-defined problems respectively. Further, interactions design problems are advocated as special type of ill-defined problems. Taking issues like creative flexibility, design complexity and structured approach to design are some of the factors that helps to understand the location of these design problems in the range of ill-defined problems.

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