

Enhancement Implementation Design as Design Thinking

¹N.R. Parmar ²M.S Shah

^{1,2}Assistant Professor

^{1,2}GIDC Degree Engineering College, Navsari, Abrama, Gujarat, India

Abstract

Sustainability is still a relatively new term in everyday public discourses, yet broad consensus is emerging that issues of sustainability should take a central part in future development strategies. Some of the professions most seriously affected by the complexities and challenges of sustainable development are the engineering professions. As a consequence many institutions are now engaged in rethinking the professional engineers' role and contribution in contemporary society and concretize the implications that such a change will hold for engineering educations. Design, on the other hand, is an old concept, but its use has always been fluent and changing. Today it is no longer solely a matter of formalist aesthetics employing materials and tangible form for iconic recognition. The New design Engineering field is rather shifting towards a reflective, creative practice working across disciplines and professions, and the objects of design are shifting towards systems, services, and experiences rather than material products.

Keyword- Design Engineering, Sustainable development

I. INTRODUCTION

The goal of this short paper is to invoke a discussion of fundamental principles of design thinking, allowing us gaining insight into the nature of design as an innate human faculty. We can find every kind of lines for the comparison between different design disciplines, their approaches and unfolding phenomena of design events in time. In addition we notice that approaches are markedly complementary. In the early days of design research Broadbent noted that all design processes are based on scientific methods. Therefore the aim was to devise rationalized procedures or rules analogous to the mathematical expressions that are sets of instructions for solving design problems. Popper noted that we cannot expect profound truth from methodology, but it may help us to clarify the logical situation and even to solve some far-reaching problems.

Design science according to Hubka and Eder is understood as system of logically related knowledge, which should contain and organize the complete knowledge about and for designing. The (design) science requires systematic descriptions (declarative knowledge and descriptive statements), which belong in the area of theory, methodology and instructions for the practical (design) activity (procedural or prescriptive knowledge), and/or (deterministic and flexible) algorithms and techniques for part processes and operations. Archer has introduced boundaries of attention in design research through identifying the following ten areas of the whole field of design (science): design history, design taxonomy, design technology, design praxeology, and design modelling, design metrology, design axiology, design philosophy, design epistemology and design pedagogy. Perhaps we can add the following additional areas: design management, design policy, design aesthetics, design semantics, design decision-making, design evaluation, design logic, design ontology, design logistics, design syntaxis, design ethics and design informatics. This prompts us to seek and define a general framework or classification for these areas.in this process we derived following point.

- Areas that define the agents of design and can describe the study of creative and cognitive activities of design;
- Areas that define the influences of design in terms of studying both internal and external experiences of designing; and
- Areas that define the operations of design in terms of studying the organization and the product of designing.

The discursive field surrounding design also accommodates several understandings of what design Thinking is. Originally, design thinking was strongly linked to the arts and craft tradition where aesthetics and essence on the one hand and craftsmanship and technique on the other were put front and centre. In such an understanding design Thinking is primarily concerned with the aesthetics and shape of an object (as e.g. in fashion design). But as technology plays an increasingly central role in most design objects today, the design thinking field has also shifted towards the field of engineering. In the engineering understanding, however, design thinking is more concerned with the functionality of design objects (e.g. in mechanical/Civil/Electrical Engineering design).

I take my point of departure in the part of the discursive field, which lies even further away from the artistic understanding. Here, design is to a greater extent seen as a way of thinking and engaging in the design process. Schön (1999) has called it the “reflective conversation with the design situation”, which emphasizes the more interactive relationship between the designer, the design object, the design situation, and the other participants in that situation (clients, colleagues, users, computers,

drawings etc.). Brown and Wyatt (2010) from the renowned design consultancy IDEO call it “design thinking”, which they describe as a human centred approach that goes beyond conventional problem solving and products to new experiences with emotional as well as functional meaning. With this reflective design understanding it is openly recognized that design does not move along a linear line from analysis to synthesis or from problem to solution. Rather it moves back and forth between different domains as the design problem(s) and solution(s) are co-evolved and continuously up for revision (Downey 2005).

There is a strong social element in this way of thinking design, which is done more in collaboration than in unison (how the artist traditionally works). Bucciarelli (1994) has phrased it as “designing is a social process” to underline that the expert designer never works in complete isolation, but is rather navigating a social network of other actors. Taking this perspective also implies a shift from focusing on the final output of design (whether it is a tangible or intangible object) towards focusing on the process itself where life and meaning is co-constructed into the design even before it is finished. This also resonates well with the participatory design approaches, which allow non-professionals to take part in the design process as well.

Our goal in this paper is to create a platform for introducing and the exchange of ideas and experiences related to the study and application of advanced technologies to fields of designing the built environment. Further we discuss terms and conditions for introducing new tools (offered by the latest developments in the fields of artificial intelligence, robotics, and image processing and information technology) and new strategies (required by the inevitable changes of the professional and educational working environments of architecture, building engineering, civil engineering, urban design and urban planning). In this regard, relevant subjects and themes include but are not limited to domains of artificial intelligence, design support environments, decision support systems, knowledge representation, human and machine intelligence, image processing, building and construction robotics, computer vision (applications and components), machine training and learning systems, case-based reasoning systems, construction robotics, computer vision, intelligent design and planning tools, computer graphics, interactive virtual realities for design and planning of the built environment, intelligent CAD/ -CAM/ -CIM/ -GIS, design and planning informatics, geo informatics, hydro informatics, building informatics, etc. These can be divided into two major categories of the applications domains and the basic tools domains. Also, the studying and discussing issues related to design of the built environment in each area of the design science will occupy a central place in this paper. In this paper we can propose the following discussion which can provide an overview of possible design research domains.

II. THE DESIGN AND DESIGN THINKING

These are the areas that define the agents of design and can describe the study of creative and cognitive activities of design.

- Design philosophy. Design philosophy is the study of ways of design thinking. It is a search for general understanding of design values by chiefly speculative rather than observational means. It can be an analysis of the grounds and concepts expressing fundamental aspects of design. The design philosophy concerns the general theory underling the design thinking. It can describe the general beliefs, concepts and attitudes about design or designer
- Design logics. The design logics are the study of principles of design reasoning and the underling foundations of the design thinking. It can describe the principles and criteria of design inference and demonstration. It can cover the arguments about the interrelation or sequence of design events when seen as inevitable or predictable.
- Design Modeling. It is a study of Cognitive models, externalizations and communication of Design idea.
- Design Epistemology. It is the study of methods of knowing, feeling and beliefs regarding Design.
- Design psychology. It is a study of mental processes and behavioral characteristics of individual and groups influenced by design activity or affected by the product of designing.
- Design syntaxis. It a study of the system of rules and structural of design process.

A. Creativity

Creativity in design concerns all processing activities of intelligent performance, which contribute to existence of design according to recognizable structures and syntactic rules. It relates to the learning and reasoning processes of designing and a starting point for perceiving design in mind for modelling an empirical existence.

- Design aesthetics. It is the study of a particular theory or conception of beauty in design.
- Design semantics. It is the study of meaning and intentions in design. It concerns the classification of changes in the significance of forms in the development of design.
- Design ontology. It is the study of the general characteristics and principles of the design process.

B. The Influences of Design

These are the areas that define the influences of design in terms of studying both internal and external experiences of designing.

1) Internal Experiences

These are the observation of design facts and design events and are considered to be the source of design knowledge.

- Design history. It is the study and analysis of design cases with regards to reasons for designing as well as social, cultural, political and economic factors with their influence on the design cases.
- Design pedagogy. It is the study of principles, methods and techniques of teaching design.

- Design evaluation. It is the study of values and criteria for the evaluation and selection of design decisions and methods for comparing different courses of action during the design process.

2) *External Disciplines*

These are the areas dealing with design facts and events as well as ways of producing design knowledge and acquiring design skills.

- Design axiology. It is the study of the nature, types, and criteria of values in design with emphasis on the relationship between technical, economic, moral, social and aesthetic values of design.
- Design policy. It is the study of a definite course or method of action selected from amongst alternatives and in the light of given conditions to guide and determine present and future design decisions. It concerns a high level overall plan embracing the general design goals and acceptable design procedures.
- Design decision-making. It is the study of design statements and the ways design decisions are made as well as the principles of design decision-making and methods for arriving at decisions during the design process.
- Design ethics. It is the study of definitions and code of conduct for the design process including all moral, social, political, cultural and personal understandings, insights and norms.

C. *Product Development*

These are the areas that define the operations of design in terms of studying the organization and the product of designing

1) *Product of Designing*

The product of design is the result of design actions, operations or processes.

- Design technology. It is the study of the principles of scientific treatment of designs and their relationships as a system. It concerns using technical processes, methods or knowledge for designing.
- Design metrology. It is the study of the qualitative aspects of measurement and weight systems regarding design.
- Design informatics. Seen from a design point of view, it is the study of information about the design process, design in an information environment and the means of collection, organization, classification, transformation, retrieval and use of design knowledge. It refers to the application of the information, communication and computer technologies to the design process.

III. CONCLUSION

Engineering is a profession in constant progression and dependent on being at the forefront of development. At the same time it is gaining more and more recognition in the broader public that sustainability should be the overarching keyword for future development. In line with this, engineering programs working with the sustainability agenda in various ways have regularly seen the light of day over the past 20 years. In this paper I have discussed how such programs could be strengthened by the active incorporation of design as Design Thinking.

With a new eye for the socio-material dimensions of a solution in its context of use, for the cultural traditions and boundaries a solution must respect, and the larger socio-political systems in which a solution must enter into and function, engineers can facilitate their technical knowledge much more constructively. Together with many other professions engineers can thus help design the sustainable solutions of tomorrow.

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