# TEAM DESIGNING – FACILITATION OF DESIGN LEARNING USING A SYSTEMIC MODEL OF DESIGN

**Marianne STOKHOLM**
Department of Architecture, Design & Media Technology, Aalborg University, Denmark

**ABSTRACT**
Future wellbeing is depending on human competences in order to strengthen a sustainable development. This requires system thinking and ability to deal with complexity, dynamic and a vast of information. `We need to move away from present principles of breaking down problems into components and give more attention to the underlying models, information management and shared goals. Simple machine understanding and obvious goals are not suitable to explain present states or how to reach a better state` (1).
`Design is a universal method in the Age of Information` (2). Education of interdisciplinary and intercultural teams in design and the understanding of design as a process of transformation and information management call for a model with capacity to facilitate both `the what` and `the how`
This paper will describe a systemic model of design based on a holistic approach to design developed by the author in relation to a design-engineering education at Aalborg University. It will exemplify how the model has been used in workshops on team designing, challenged design learning and affected design competence. In specific it will investigate the influence of visual models on the perception of design, design thinking and communication in design. Trying to answer the question: How can visual system models facilitate learning in design thinking and team designing?

*Keywords: Design learning, design thinking, system models, teamwork*

## 1    INTRODUCTION

The context of design is changing along with the development and shifts in society. Design as innovation is about to become a universal discipline in the Age of Information (2). To understand what this mean we must take a look at models behind mindset which affect our approach to the world including design.

Western culture, behind the actual type of society, is still to a high degree influenced by ancient Greek paradigms and models structuring the world. An example is the focus on separation, between `me and it´, ´either or´ and `out site and in site` in opposition to links and intersections.

Descriptions and understandings of and within any society, its individual lives and human activities are based on models, most often unconscious, creating a specific context within which we think and act. The metaphor of the industrial society, where industrial design is rooted is the `machine` consisting of a number of parts mounted to function as a mechanical whole. Machine creation is based on knowledge produced through science and analysis of `what is`. The machine model and the trust in its ability to work well became the predominant reference along with the analytical method, for description, creation and understandings of other matters in society and life such as for examples economy, design, education and personal development.

Along with the Age of Information and the Network Society took, the machine model and the associated mindset, needs to be replaced. `Simple machine understanding and obvious goals are not suitable to explain present states or how to reach a better state` (1) New models are needed for a global time where innovation is considered a mean for development of society and -according to Einstein- imagination more important than knowledge – knowledge is limited, imagination encircles the world; models which can help us handle intangible processes of increasing complexity and dynamic and models which can support the creation of `what has to come`.

In the creating of a new platform for design we need to reconsider our Greek roots and gain inspiration from others societies like Asia with its economical development and `the Medici`s, which created a remarkable burst of creativity in fifteenth-century Italy by creating an intersection of fields, disciplines, and cultures` (3). `Pursuing design as an interdisciplinary process is not easy` (4). In search for at new position for design and means to support design learning for more people we must be aware of suitable models to describe, support understanding and facilitate design.

## 2 CHALLENGES FOR DESIGN EDUCATION

### 2.1 The values of design and innovation
Cultural and economic there is a focus on design and innovation. Design products are expensive and highly valued. Successful designers are idols and design products become icons. Belonging to the creative class gives high status. Innovation has a high political priority as a mean for economical development. Regions like Silicon Valley with its innovation and entrepreneurship attracts talents and capital. But `although industry cooperation demands creativity it is considered less serious than actual knowledge in the university context` (5).

### 2.2 Context of design education
Denmark has a long tradition for design and designs are an integrated part of the individual life and society. Design education is now established in Secondary Schools, University Colleges and Universities with new profiles and approaches. Students are eager to attend design education to become designers and members of the creative class.

At Aalborg University an Industrial design-engineering education focusing on the process of design was set up within the engineering faculty. The new education had to fit the traditional university education paradigm, including problem based approach based on scientific analysis. Innovation and entrepreneurship is encouraged but attention to creativity and process navigation is lacking.

The education faces several challenges including: teaching formats and learning paradigms; staff perception of design; student expectation, values and mindset and lack of a common ground.

### 2.3 Need for new models
Interdisciplinary cooperation is proved to improve innovation. But integrating two traditional disciplines is also like mixing oil and vinegar; it creates a refined blending but need constant stirring. `The theme 'integration' is definitely fascinating. The word very precisely catches the true meaning of design: In fact, 'design' could be replaced by 'integration' (6).

Existing design models do not structure what is actually involved in design thinking concerning both information on the matter (the what) and on the methods (the how). Instead of an interactive system model, combining the two they provide fixed stages or procedures.

`To bring world toward sustainability –or any other goal- we need to take different kind of steps, which require different kind of knowledge, talent skill and work` (1).

The need within a design-engineering education that aims for creating competence in simultaneously handling of matters and methods is to establish a common ground for the two approaches by creating a firm structure in which dynamic interactions can take place; a model which present a disciplinary independent framework and provide an arena for interdisciplinary cooperation.

## 3 MODEL BASED DESIGN LEARNING

### 3.1 A systemic model of design
The model has emerged over period of several years. The overall method can be characterized as opportunity driven action research organized as a continual interplay of creation, action and reflexion involving the creator and a diversity of users. From a simple structure the model has included more parameters, aspects and functions offering more use options but still remaining its simplicity. The progression resulted in a transformation from a concept of design as a cross field to a holistic system for innovation. `Three levels of the model along the development process stood out by proving their ability to work out for a diversity of tasks and users who also named them` (7).

`Design Field` is a definition of the man made inspired by Aristotle's a concept of things and represent design as a cross field of object and objective; -defining object as integration of form & matter and

objective as integration of source & purpose. Aristotle's parameter terms were translated to: Aesthetic & Technology and Philosophy & Strategy.

In `Design Compass` the design concept is placed in context by further adding four basic design contexts integrating with the object and objective including the parameters; Man & Environment and Business & Culture.

Where both Design Field and Design Compass is concerned with design as `the what`; the information concerning specific parameters, the Design Navigator hold both the "the what" and `the how`; the thinking modes.

`Design Navigator` represent an integration of design in context with the design thinking process represented by `4 levels of approaches between abstraction and concretization` (8), paired up with the according basic and contextual design parameters, thus providing a framework for simultaneously managing both information content and processing. With reference to the links between parameters and modes the according representations was named Strategic Statements, Interaction Scenarios, Product Principles and Product specification, thus establishing a holistic and integrated structure for innovation.

The model is not a process diagram, but a structure for facilitation of thinking, actions, discussion and decision making during the process of design. The model represents the DNA of design. It is in itself is simple and the use principles few and clear, which mean that it can be used for many types of design; different from case to case; during the entire process or only parts of it and by an individuals and teams.
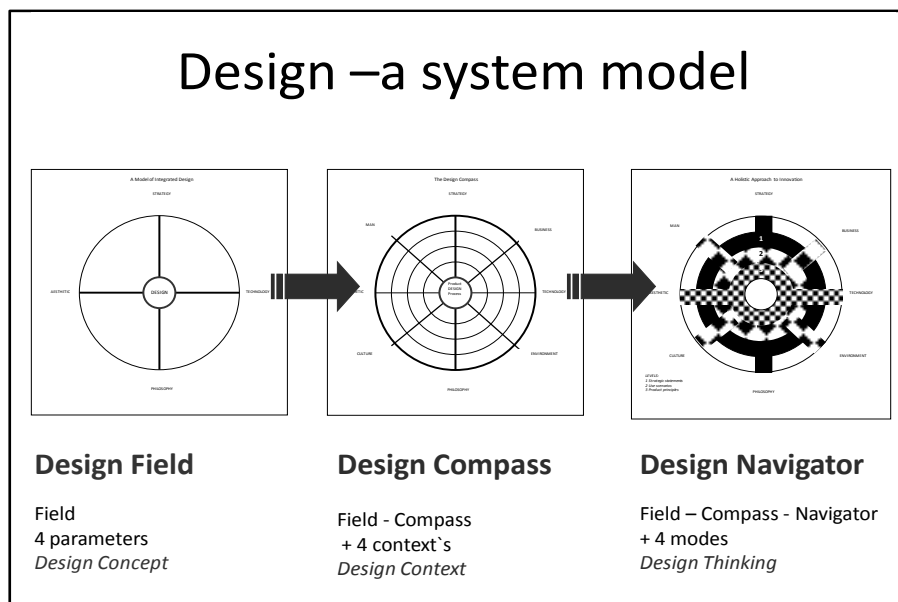


Figure 1. Systematic Model of Design

## 3.2 Design Dancing

The design activities unfold in the choreography with which the model is used. The pattern is regulated by the principles within the system and every use has its own specific choreography.

`The process of design is constant, the execution variable. In that respect, Continuums way of working is analogous to the Chinese martial arts discipline called Tai Chi Twan, consisting of a highly refined set of basic movements that do not change, what changes is the pace and rigor with which the movements are performed. Tai Chi incorporates strategy into a kind of dance. Design is also a kind of dance and Continuum`s choreography begins with a backwards step. The first thing we do in approaching any problem is to step backward` (4). `If we designers look to art to receive some sort of help in our work, it is primarily to dancing, the art of dance, to ballet, to sport dancing, to dance games and dance groups, we must turn our eyes` (9).

## 3.3 Model implementation in course program

The bachelor program in design-engineering is organized with a progression in complexity of design tasks, including more parameters and design methodologies requiring increasing competence in integration. The models have been used in lectures, exercises and team based project work. They have provided simple visual representations of the complex matter of design, the intangible design process and the invisible design thinking.

The models are represented graphic in the form of power point and posters; in physical game boards size 40 x 40 cm for table use and in floor versions for walking the talk and thinking,

The models have basic been used as reference in communication about design establishing a shared understanding and for mapping and linking design issues. They have supported design work by structuring and processing design information; facilitated navigation in the design process; supported organization and implementation of design methodologies and for tracking and reflecting upon the design process and related design learning stated by the students in a process report that goes with the product report in all project work.

Further models representing simplified parts of the system has been used in the program with the purpose of demonstrating principles within the system and framing actions in and reflections on the design activities. Exercises in specific skills like shifts in thinking modes between concrete and abstract thinking to raise the flexibility in mindset and energize ideation has been supported by floor models.

## 3.4 Examples of learning exercises

The `Design Field` as a representation of the two dualistic parameters in a design product is easy accepted when presented. The intangible separation of a product in form and matter and the abstractive parameters aesthetics and technology is much harder to perceive.

The `Design Compass` including all parameters and links expose the product or the `what` in question and thus create an awareness of the holistic matter of parts and interactions actually involved, which often amaze students, who found their former perception of design limited to just some of the parameters. Through analysis of existing products the students experience the capacity of the model and exercise divergent thinking. Through redesign they experience the influence on the totality of changes in one parameter. Through creation of a new design solution they experience that the parameters count for whatever design subject and exercise the handling of parameter related information in convergent thinking. Working on the model requires a clarification of the 8 types of parameters. Small cards with this description has been tried out but killed the dynamic. Single pictures of each parameter worked more smoothly to memorize the types.

The `Design Navigator` including both the product or `the what` and the process or `the how` in question and thus establish a higher level of holism but also more complex system. To be able to work on this model, the awareness of different working and thinking modes needs first to be established. Initially awareness of the existence of a structure beneath the more or less chaotic design process must be established. For this purpose a model names `Stepping Stones` is introduced. The Stepping Stones`` model is a series of 6 `stones` for design work and spaces for different kind of thinking. This model provide a structure for design -not as a stage gate model- but as pathway of islands for the journey from a present stage to a future situation to make the students aware of their state of work and the links between them. Parts of the `Stepping Stones`, provided as small round carpets are used to train the different kind of mindset and thinking and to experience how jumping between them can energize ideation. In other cases both the `Design Compass` and `Stepping Stones` model are drawn with chalk on the floor to support interaction of more people.

## 4 CHALLENGES IN DESIGN LEARNING

### 4.1 Design learning

The goal of design learning is to create competences in value based transformation and innovation A matter of transformation and information management, which requires skills in creativity, ideation process navigation and reflection.

`Design work depends on constant flow of creativity. Creativity in conceptual design can be modelled as a process of knowledge creation` (10).

`Design learning includes personal and professional formation. Personality formation is a process where we exceed ourselves and become able to decide what is important. The creative process and the personality formation process contain the same elements of sensuality and require the same excess power and discernment` (5). `Learning involves both horizontal and vertical development` (11). Horizontal development moves the attention towards new areas, create a wider knowledge base and enlarge the horizon and overview. Vertical development is about raising capability and quality of competences trough intensive training and high goals. Education ought to be replaced by learning management as good education is about leading some ones process.

## 4.2  University education
University educations are rooted in the scientific paradigm with impetus in problem finding, analysis and proofs rooted in `what is` and not leaving much space for the artistic paradigm with impetus in opportunity seeking, experiments and presumptions of `what has to come`.
Engineering traditionally aims at product development based on systematic thinking and procedures to obtain specification on well-funded data. Design in opposition aims at concept development based on intuitive thinking and experiments to obtain creations on a value based assessment.
The Design-engineering program in Industrial design starts on 3$^{rd}$ term. The approach described above rules the first 2 terms, which do include space and composition exercises but no basic creativity or sketching training. Project work is solely based on analysis and focus is on producing a report and demonstrating a scientific approach. No framework concerning the ideation process and process reflection is provided.

## 4.3  Student` background and mindset
The generation of students who attends the design-engineering education is occupied with their personal life project. They wish to stand out and to make a difference. They tend to see nothing in between success and failure and they want success immediately and without too much effort. In an uncertain time they ask for recipes and security. These attitudes create a barrier for design learning, where you need to focus on the task, come out of your comfort zone and aim at exceeding yourself.
It is a generation familiar with navigating in a waste amount of information and with image reading but with difficulties concerning presence and immersion.
This situation creates a challenge as design requires abilities and traits like; empathy as outwards attention and sensitivity; humility concerning the task and future; trust as confidence in one`s own ability and the future and curiosity as an open mind towards the unexpected.

## 4.4  Cultural rooted models
The main challenge in design learning and education are the models in our mind- culturally inlaid and often unconscious - ruling our thinking and ways of doing things. Western culture is rooted in a separation paradigm; science versus art; body versus soul; work versus play; problem solving versus opportunity seeking; backwards thinking versus forward thinking, where the question is either or and the one is considered more legal than the other. `Our language is created to describe a picture of the world, where everything is separated from each other .We are on the track to realize that the opposite is true` (12).
`We debate and challenge our models far too little, especially the models in our head. Most of them are to narrow, too linear to lacking in variability, diversity and other aspects of real-system complexity` (1). Obvious if our models are faulty all the skillful and well-funded implementation will not get us to the desirable goal.
Design is relations, links in time, flow and synergy. We do not yet understand exactly what is the pattern of current design identity but it approximately the opposite of boxes. Design is a long insistence of structure in a stream of information. The model is the bearer of the principle of design.

## 5  CONCLUSION
The aim of design learning is to support development of knowledge, skills and competences in:
• Holistic approach; -integrating matter and methods
• Creativity and innovation; -based on design thinking
• Co-creation; -interdisciplinary team designing
The conclusion will try to answer the question:

- How can visual system models facilitate design thinking, design learning and team design?

## 5.1 Holistic and integrated design

Engineers tend to only consider matters of design which can be specified and quantified whereas designers are familiar with the work with assumptions and drafts. Both of them pretend that what they work with is design. Engineers have a preference the systematic thinking mode, while designers prefer a more intuitive approach. Both positions can benefit from each others.

A common and ground visualizing both site of design brings the two sites together and establish a holistic and interdisciplinary design arena; a firm structure for dynamic design dancing allowing the participants to exceed the limitation of their professional boarder and personal self-perception.

The learning provides wider knowledge about design, skills in empathy and communication and competence to exceed ones professional boarders.

The model has also shown to be use full in others professional educations like design psychology and business programs as well as in seminars and conferences where issues in design are presented and discussed in interdisciplinary and intercultural forums; in several cases used by others than the author.

## 5.2 Creativity, design thinking and innovation

The bachelor program in design-engineering is concerned with integrated product design based upon an introductory year common to industrial design, architecture and urban design students. Unfortunately at the moment this year is dominated by a scientific and analysis based approach with impetus in existing works and do not provide a core program in creativity and visual communication skills. This leaves only two years to create knowledge, skills and competences in integrated design of which some time must be used for un-leaning of habits blocking creativity.

Without basic training in creativity the students find it hard to think out of the box and make fast temporary decisions. Involvement of the body in the learning process, increase the ability to use the knowledge in practice and to make decisions, which is the reason for introducing the thinking exercises on carpets and chalk patterns on the floor. The models support the learning by providing a safe ground and thus help the students create trust in their ability.

The system-model can be compared with a music instrument on which different tones can be induced and composed to music by both amateurs and professionals. Like flute playing the ability and competence in playing increase with the amount of experiments and exercise, but beginners will experience sound and be able to play simple melodies already a short instruction.

## 5.3 Teamwork in designing

With the model centrally placed during team work the design arena is marked, attention and focus on the common assignment obtained and the participants can easy and continuously refer to the states, parameters and modes in the process and thus facilitate their own fort coming in a convenient way.

Several design-engineer candidates get assignments in companies and are appointed design manager after few years due to their skills in team work and ability to share the design process with others.

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