

An introduction to the concept realisation process..

Design Strategy

“Design is not Engineering”

- Design is an art..
 - *“To conceive or fashion in the mind; invent,” and “to formulate a plan”*
- Engineering is a science..
 - *“The application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems.”*
- A neutral distinction is:
 - They are both *“overlapping forms of problem-solving with a defined distinction being the application of “scientific and mathematical principles”.*
 - How much science is applied in a design is a question of what is considered “science”; along with the question of what is considered science are definitions of social science versus natural science.

“Design is a process”

- Is a verb [action] in this context; not a noun [thing]..
 - As a verb, "to design" refers to the process of originating and developing a plan for a product, structure, system, or component with intention.
 - As a noun, "a design" is used for either the final (solution) plan (e.g. proposal, drawing, model, description) or the result of implementing that plan in the form of the final product of a design process.
- This classification aside:
 - In its broadest sense no other limitations exist and the final product of design can be anything from clothing to graphical user interfaces to skyscrapers. Even virtual concepts such as corporate identity and cultural traditions such as celebration of certain holidays are sometimes designed.
 - More recently, processes (in general) have also been treated as products of design, giving new meaning to the term *process design*.
 - It can be applied to anything.

Design defines form and function..

- The design process can be defined as “The management of constraints” two kinds of constraint are definable:
 - Negotiable.
 - Non-negotiable.
- The first step in the design process is:
 - The identification, classification and selection of constraints; the process of design then proceeds by manipulating design variables so as to satisfy the non-negotiable constraints, optimizing those which are negotiable.
- It is possible for a set of non-negotiable constraints to be in conflict, resulting in a design problem with no solution.
 - In this case the non-negotiable constraints must be revised.
- For example: Take the design of a chair;
 - A chair must support a certain weight to be useful, this is a non-negotiable constraint, the cost of producing the chair might be another.
 - The choice of materials and the aesthetic qualities of the chair are negotiable.

No two solutions are the same..

- Designing ..
 - Requires a “designer” to consider the aesthetic, functional, and many other aspects of an object or a process, which usually requires considerable research, thought, modeling, interactive adjustment, and re-design.
- With such a broad definition..
 - There is no universal language or unifying institution for designers of all disciplines; this allows for many differing philosophies and approaches toward the subject.
- Two “designers” resolving the same constraints may reach entirely different conclusions, each valid in their own terms.
 - The outcome of any design relies on the process management, experience and personality of the “designer”.
- Outside influences and random factors may also be brought into play:
 - Often a designer (especially in commercial situations) is not in a position to define purpose; whether a designer is, is not, or should be concerned with purpose or intended use beyond what they are expressly hired to influence, is debatable, depending on the situation.
 - In society, not understanding or disinterest in, the wider role of design, might also be attributed to the commissioning agent or client, rather than the designer.

Any function can be improved “by design”..

- There is no such thing as a “bad” design; but where the process is applied badly it can lead to a poor design result..
- Poor design outcome occurs as a result of mismanaged constraints..
- The most successful designs are where the function defines the form..

Applied art..

- In the realm of the arts, design is more relevant to the "applied" arts, such as architecture and industrial design.
- Today the term design is widely associated to modern industrial product design as initiated by Raymond Loewy and teachings at the Bauhaus and Ulm School of Design (HfG Ulm) in Germany during the 20th Century.
- Most "western" design schools teach process using these principles.

Design is:

- Rational
- Organised
- Linear
- Iterative
- Considered

Design is not:

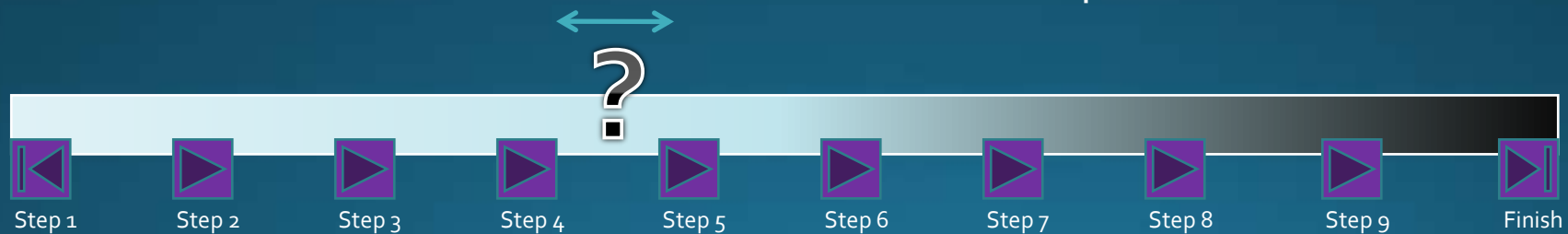
- Style
- Random
- Cosmetic
- Thoughtless
- Effortless

Design constraints include:

- Purpose
- Economics
- Aesthetics
- Ergonomics
- Material science
- Safety
- Cost
- Production

Design takes discipline:

- The first act of the “designer” is to establish his place in the process..
 - Some developments have steps already undertaken, and the process may be partially complete.
 - Steps may need to be revised or repeated.
 - A redesign includes an evaluation of the existent design and the findings of these evaluation needs are the ones that drive the redesign process.
 - From an evolutionary point of view the functionality, and aesthetic sophistication of an artifact is best understood as a result of redesign rather than design, as all successful artifacts are outcomes of cumulative improvements.



The Design process – Act 1

- Phase 1 - Conceive
 - Requirement Definition
 - Establish a concise brief..
 - Commercial evaluation..
 - Research of embedded elements..
 - Competitive analysis..
 - Conceptual Design
 - Schematics..
 - Block models..
 - Sketches..
 - Rendered Images..
 - Explanatory notes..
 - Concept Review
 - Stakeholder evaluation..
 - Constructive and informed criticism..
 - Definition of areas for rework and refinement..
 - Concept Refinement
 - Iterative changes and re-evaluation to an agreed final selection..

The Design process – Act 2

- Phase 2 - Realise
 - Detail Design
 - The application of materials and processes..
 - Engineering assessment and disciplinary reports..
 - Thermal..
 - Electrical..
 - Structural..
 - Mechanical..
 - Other..
 - Definition of parts and assemblies..
 - Selection of integrated technology..
 - CAD modelling..
 - Tooling Definition..
 - Detail Review
 - Stakeholder evaluation..
 - Constructive and informed criticism..
 - Commercial review..
 - Definition of areas for rework and refinement..
 - Detail Refinement
 - Iterative changes and re-evaluation to an agreed final selection..

The Design process – Act 3

- Phase 3 - Manufacture
 - Verification
 - Modelling..
 - Scale..
 - Virtual..
 - Full size..
 - Prototyping..
 - Testing..
 - Documentation
 - Drawing package..
 - Bills of material..
 - Tooling definition..
 - Software definition and creation..
 - Pre-production
 - Documentation review..
 - Vendor assessment..
 - Value and production engineering..
 - CNC programming..
 - Production sample generation..
 - Manufacturing release