

# Design methods applied in the design process.

## Introduction.

Creating a design is a creative process. It is the translation of abstract concepts into concrete projections of future realities. The design process resembles the dream process of man. A person's brain is constantly receiving information. During sleep, the brain can no longer receive new information. The brain then tries to forge the information present into a somewhat coherent story. The dream is then, just like with design, the final outcome of the process.

Although a lot of research has been done on design methods or design methodology<sup>1</sup>, the design process has not (yet) been fully explained. This letter attempts to clarify the design process. Hopefully, this will give the designer some useful tools that he or she can use to his or her advantage in the design.

## Framework.

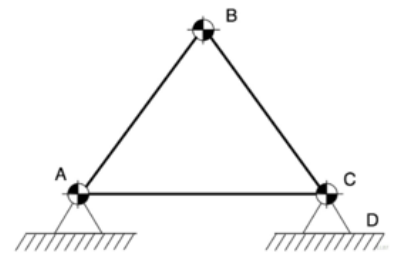
A design is a description of something new or a description of something that exists. A design is therefore a description (projection or model) of (future) reality. So a design is the outcome of the 'process' of designing<sup>2</sup>. A process, in turn, is a series of successive actions to achieve a certain goal. These actions can be predetermined and recorded in a (design) method.

**Are there any general valid design methods that are universally applicable to a design?**

## History.

Before we answer this question, whether there is a general design method, it is instructive to look at the past. How did design work in the past?

Renowned designers, such as Leonardo da Vinci, Christiaan Huygens, Archimedes, and others, are generally individuals with a broad general knowledge of technology<sup>3</sup>. Little or nothing is known about how the design process was applied at the time. What is known is that the design was a craft. It was a craft because the system of the '**master guild**' principle was used. In this way, the craftsmanship was passed on from generation to generation. At that time, the transmission of knowledge took place in the form of facts, the so-called construction principles<sup>4 5</sup>. It was only during and after the Second World War, partly because the designs became more complex and there was a need for a more efficient design of the design process, that full attention was paid to the design process itself.



Each discipline had and still has its own facts. An example of a fact or a construction principle in the construction world is that the triangle is the most stable shape for a structure.

<sup>1</sup> [https://web.archive.org/web/20070203212408/http://www.designresearch.nl/DRN\\_links.htm](https://web.archive.org/web/20070203212408/http://www.designresearch.nl/DRN_links.htm)

<sup>2</sup> [https://en.wikipedia.org/wiki/Design#Design\\_process](https://en.wikipedia.org/wiki/Design#Design_process) <https://en.wikipedia.org/wiki/Design#References>

<sup>3</sup> Technology is the application of conceptual knowledge to achieve practical goals, especially in a reproducible way.

<sup>4</sup> YouTube Mechanical Principles Part1 [https://youtu.be/wu4rqAqx4\\_c](https://youtu.be/wu4rqAqx4_c)

<sup>5</sup> Abstract from some of the information from a great book by John Chris Jones, called Design Methods (Van Nostrad Reinhold, 1992). <https://degraaff.org/attic/design-methods.html>

## Process steps.

It is generally agreed that the design process consists of the following process steps: analysis, creation and assembly.<sup>6 7</sup>

However, anyone who has carried out even a simple design project knows that it does not follow this simple sequential process. The stages mingle and overlap and are cycled through many times. Simply put: Design is the process of translating concepts into knowledge through an interactive process.

## Analyse.

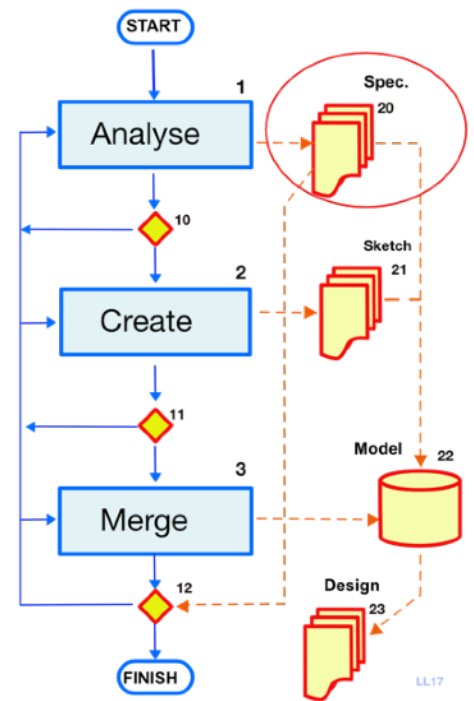
The first step of the design process is to analyse the problem or the task (1). This first step in the process is also known as empathizing with a problem.

For complex designs with many variables, it is advisable to divide the design as quickly as possible into pieces that are manageable for humans, the human scale. Analytical methods are often used to analyze the design problem. The analysis process, in turn, is divided into an orientation, an analysis and a design specification phase. There is a lot of information in the professional literature about the various analysis methods that can be applied in this phase. A non-exhaustive list of these is: Structured Analysis, Flowchart, SWOT, Value Analysis, and QFD.

A very efficient tool in analyzing the design problem is to create a (design) specification<sup>8</sup> (20). The (design) specification can be seen as the conclusion, the end result, of the analysis phase.

The characteristic of the analysis phase is that it can (must) be used in a very systematic and analytical way. Most of the time, designers, naturally creatively gifted people<sup>9 10</sup> dislike imposed systematic work. The creatively gifted designer wants to start creating as soon as possible. He or she wants to do the fun things as soon as possible.

There is a danger that if the next phase, the creative phase (2), is started too quickly, elementary things will be overlooked. It is recommended to put 80% of the available energy into this phase. Although this may seem unnatural, a thorough analysis prevents the need for too many time-consuming iterations (10-11-12) in the design process.



<sup>6</sup> The VDI 2222- & VDI 2221- methodology is a method that has been widely used, especially in Germany, since 1954. Excerpt from Methodical design explained. Laurens van Lieshout. 2024 ISBN: 9789403729435.

<sup>7</sup> D. Castle. et al. Engineering is evolution: a perspective on design processes to engineer biology. (2023) <https://www.nature.com/articles/s41467-024-48000-1>

<sup>8</sup> The art of making a design specification White paper: [https://lieshoutconsultancy.nl/?page\\_id=81](https://lieshoutconsultancy.nl/?page_id=81)

<sup>9</sup> Zenasni, F., et al., How does creative giftedness differ from academic giftedness? A multidimensional conception, Learning and Individual Differences (2016), <http://dx.doi.org/10.1016/j.lindif.2016.09.003>

<sup>10</sup> 'Action is the foundational key to all success.' Pablo Picasso. Cite: Paik, S.J. (2013). Nurturing Talent, Creativity, and Productive Giftedness. In: Kim, K.H., Kaufman, J.C., Baer, J., Sriraman, B. (eds) Creatively Gifted Students are not like Other Gifted Students. Advances in Creativity and Giftedness, vol 5. SensePublishers, Rotterdam. [https://doi.org/10.1007/978-94-6209-149-8\\_8](https://doi.org/10.1007/978-94-6209-149-8_8)

## Create.

After all the data has been analyzed and the frameworks of the design have been determined, the creative creation process follows. In the professional literature, not much is known about how exactly this creation process takes place<sup>11 12</sup>. Creativity is the ability to find new and/or unusual solutions to existing problems. How exactly the creation process proceeds is a process that is not yet understood. What is generally known is that it is necessary to have a (mental) model<sup>13</sup> and a certain incubation period is required.

**Without a (mental) model, it is not possible to create anything.**



*A sketch is a simple (mental) model.*

In the past, the creation process was often the product of one person. It could be overseen by one person. With the increasing complexity of the design process, it is more and more necessary to divide the process over different systems and sublevels in order to keep it manageable. Essential in this way of development is having a universal communication medium. The traditionally used drawing is no longer sufficient here because not everyone is trained to read it. The virtual model used in many companies is not appropriate because it is the interpretation of only a few people. This is therefore the core of the problem in the creation process.

### **How is communication between the different members of the design team?**

Often the members of the design team have a different background in the (de)coding of communication models<sup>14</sup>. A chemist communicates differently than a salesperson. Without a model or something similar, all participants in the design process cannot communicate with each other. As a result, not all knowledge is fully utilized at the same time. Usually this knowledge is introduced into the design afterwards, in the form of costly and time-consuming design iterations.

Because there is no system available (yet) to quickly give the feasibility and an opinion on the critical details of a design, it is advisable to use the sketch<sup>15</sup> for the time being. If this is not possible to use a sketch as a communication medium, then the most logical step is to concretize the model as quickly as possible in the form of a proto.

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<sup>11</sup> TEDx A Deeper Understanding of Creativity | Daniel Cape | TEDxAsheville <https://youtu.be/Lr8PhkTrx1E> (13min)

<sup>12</sup> What is Creativity? <https://youtu.be/coJ2T0i0tQ>

<sup>13</sup> What is Mental Model | Explained in 2 min <https://youtu.be/n74cqxx9qqA>

<sup>14</sup> Communication is commonly defined as the transmission of information. There are many forms of communication, including human linguistic communication using sounds, sign language, and writing.

<sup>15</sup> White paper: An ode to the sketch. [http://il.lico.nl/White\\_papers/Index.html](http://il.lico.nl/White_papers/Index.html)

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The creative design process is similar to relativity and quantum theory<sup>16</sup>, in that similar methods performed by different designers give a different design result. Here, as in the design process, subatomic reality is a flow of energy and a network of interrelationships in which creativity and relativity determine the outcome. Apparently, our brain unconsciously reorganizes the information, which leads to creative solutions.

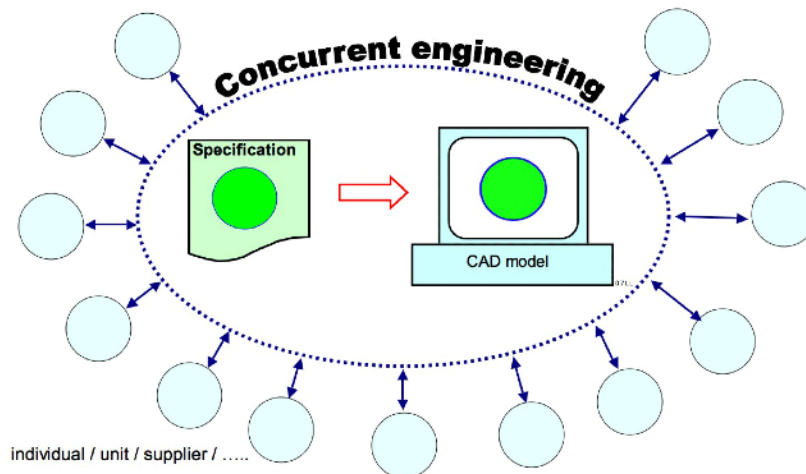
There are several methods<sup>17</sup> to achieve the "aha" or "eureka" effect. The most common method is to sleep on it. Other commonly used methods are: analogies, abstraction, brainstorming, lateral and morphological thinking.

What is characteristic of all these methods is that they need a (mental) model and sufficient incubation period. By forcing the designer to spend enough time in the analysis phase with the prohibition (deferred reward<sup>18</sup>) to create, the incubation period in this phase can be extremely shortened. Another characteristic is that the design process is an iterative process. It often happens, because people get stuck or because additional data is necessary, it is necessary to go back to earlier phases of the design process.

## Synthesis.

The solutions devised in the previous phase are brought together again in this phase into a whole. In addition, as in the previous phases, an assessment against the (design) specification will take place. If the assessment is negative, it should be returned to earlier phases.

Usually a virtual model of reality is used for the synthesis process. In the 'concurrent engineering' (parallel development) model, this is the CAD model. With the help of this CAD model, various test techniques, which test the model against the (design) specification, can be realized. Some commonly used test techniques are: Digital twin, HIL simulation, black box, market and lifespan tests.



*Concurrent engineering.*

Ultimately, the outcome of the design process, of analyzing the process steps, making and reassembling, is a design.

## The design is a description (projection or model) of the (future) reality.

<sup>16</sup> Theory of its interactions with energy on the scale of atomic and subatomic particles.

<sup>17</sup> For a comprehensive list, see; [http://www.mycoted.com/Category:Creativity\\_Techniques](http://www.mycoted.com/Category:Creativity_Techniques)

<sup>18</sup> Deferred gratification is a concept in sociology that refers to the ability to delay immediate rewards or pleasures in order to achieve long-term goals or benefits.

## Advocacy.

Many of the people involved in a design base their design decision on their own interests. Because a project team works with team members with different backgrounds and therefore different (own) interests, it is important that the team members know each other well. One of the biggest pitfalls<sup>19</sup> in the design process is that the person with the most influence (power) leaves his or her mark too much in the design. Another pitfall is merging designers with the same characters. For the leaders (project leaders) of a design team, the big challenge lies in finding a good balance.

## Design technology.

The role of information technology in the design process is increasing. If the capacity of the virtual model were large enough, an infinite number of future realities could in principle be simulated. Designing, in its ultimate form, would then come down to choosing one of the infinite possibilities<sup>20</sup>. Or in other words, eliminating the worst solutions.

## Summary

There is no such thing as a universally valid design method. What is common is that every design method consists of an analysis, a creation, and a merging phase. In each of these phases, specific skills are necessary to achieve a high-quality design. These skills can be learned by being aware of the phase of the design process as a designer. A practical tool when learning to design is to physically close each phase with a document. In this way, the design process is divided into manageable phases. Hopefully, this will give the designer some useful tools that will benefit his or her design.

For more detailed information, see the book: **Methodical Design explained**. Insight into the methodical design process as it is applied in companies. [https://lieshoutconsultancy.nl/?page\\_id=556](https://lieshoutconsultancy.nl/?page_id=556)

Comments, of any kind, are always welcome.

Laurens van Lieshout

*Rev. 1 publish in 2008 in Dutch language.*

*Rev. 2 translation in English language.*



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<sup>19</sup> Mierlose Pit – No-nonsense projectmanagement. (Dutch language) E-pub ISBN 9789403751078 Paperback ISBN 9789463427470.

<sup>20</sup> White paper: Simulation driven design The outlook from the future design is within the simulation. [https://lieshoutconsultancy.nl/?page\\_id=81](https://lieshoutconsultancy.nl/?page_id=81)