

Stuck in a material, or how to approach constraints as gifts

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Abstract

One of the objectives for conducting research in the field of design is to increase the knowledge about the design processes and that could lead to more satisfactory products. In this paper we will look at some examples that seem to have had influence from research. Some of these examples show success and others were not so successful. This is a very complex and large field and the ambition here is not to cover this in a 'scientific' way but in a 'designerly' way, i.e. heavily constrained and at the same time with an optimistic approach. Constrained because we will only investigate a few examples and only in some aspects. It is optimistic since the hope is that you, the reader, will find this interesting and maybe even useful.

The examples are mostly from the field of interaction design and range from case studies, research papers and a radio program. But the results cover a larger field.

In more detail this paper discusses these examples with the help of the concepts of 'design space' and 'constraints'. Design space is here used to denote all the possible design solutions. Constraints are sometimes looked at as something negative, something that prevents projects from being successful. This may of course be the case sometimes, but more often constraints should be looked at as gifts from heaven. A good constraint can save lots of unnecessary work. There are different kinds of constraints and Gedenryd (1998) identifies three different categories namely rigid, somewhat flexible and completely flexible. Legislation is an example of a rigid constraint while client-imposed constraints are regarded as somewhat flexible. Designer-imposed constraints are completely flexible. It is of vital importance to have a deep understanding of the different constraints since only rigid constraints define the border of the design space. Designer-imposed constraints can be mistaken for rigid ones and thereby preventing the designer to construct a 'good enough' solution.

In some of the examples the designer has taken the material or technique to build the solution with for granted. We can say they did not recognize how large the design space actually was. A result of this is that the solutions were not 'good enough'. Another way to put this is to say that they did not get a good enough idea. And since it is not clear how ideas are constructed it is important for designers to have experience of reliable methods to use during the design processes.

Designer-imposed constraints are one of the designers' most powerful tools. One reason is that they help in temporarily framing the work.

When a designer sets the constraints in order to explore the design space (s)he uses her/his experience and judgment. Therefore knowledge about methods and methodology is not enough.

Introduction of the ‘design space model’

In a previous paper (Westerlund, 2005) I have described the ‘design space model’ which is an alternative and relatively simple model of the design process that can be used as a conceptual tool during a design process. The model also provides a simple methodological framework for understanding the different approaches with which methods can be used. The model uses the ‘design space’ as a conceptual tool that can be used both for designing and understanding design processes. The design space is here understood as all the possible design solutions. In reality the design space is an extremely complex multi-dimensional space containing an endless amount of solutions, but we are here only interested in it as a concept.

The model claims that all design work supports the understanding of the ‘design space’. This means that all the different methods and techniques used during the design process will result in some knowledge about the design space. If a solution seems to work, it lies within the design space. If some method shows that certain aspects will not be suitable these are outside of the design space. The model can be seen as a complement to other models.

Key concepts

The key concepts are *design space*, *exploration*, *experimentation* and *constraints*. The *design space* is a representation of all possible solutions. In reality the design space is an extremely complex multi-dimensional space containing an endless amount of solutions, but we are here only interested in it as a concept. The design space provides a conceptual tool representing what the design work is all about. The design space provides something to aim ones intention at during the whole design process.

“... you begin by having something you want to solve or prove, and work backward from there, rather than forward ...” (Gedenryd, 1998: 66).

From all work done during the design process we construct knowledge and experience of the design space, i.e. the possible solutions. We learn and get experience of the design space both when finding ‘stuff’ that works, i.e. fit into the design space, as well as when finding ‘stuff’ that does not work.

Designers can choose to work with many different methods to understand the design space and perhaps more important is that these methods can be used with different approaches. Some of the main approaches can be described as *exploratory* and *experimental*. An exploratory approach has the “emphasis on clarifying requirements and desirable features ... and where alternative possibilities for solutions are discussed” (Floyd, 1984). While when having an experimental

approach “the emphasis is on determining the adequacy of the proposed solution” (Floyd, 1984).

In my previous paper the emphasis was on the concepts design space, exploration and experimentation. In this paper the focus is on constraints. *Constraints* are recognized as important aspect of design work by many writers. Lawson (1997: 90) and others have recognized that constraints cover a scale from flexible to rigid. The rigid ones can come from legislation, somewhat flexible can be the constraints that clients provide and the flexible ones come from the designers themselves.

“... constraints become so powerful under the designer’s own command. A well chosen constraint can be very helpful ... [by] reducing too wide a range of options ...” (Gedenryd, 1998: 75).

Examples

Below follows a couple of cases of which some are not so successful. The idea is not to point them out as especially bad. Lawson (1997: 227) says that “[t]he life of a design critic is in truth far easier than that of the designer!” Therefore I would prefer not to reveal their identities, since they are merely examples for discussing the designer-imposed constraints.

Example 1, eight operations for a stamp

The first example is from the Swedish Post (Posten). In a radio program (note 1) it was revealed that the cashier had to perform over eight (8) different operations to sell a stamp. six mouse clicks, one bar-code scanning, a couple of key presses, taking the receipt from the printer and of course giving the customer the stamp and change.

“I say to the computer that I will sell a merchandise. Then I scan the article’s bar code, end the scanning procedure by clicking with the mouse, press that the item will be paid by cash or credit card, end that procedure, type in the amount received, end that procedure, etc.” says the cashier (my translation from recording).

The development of the routines, software and hardware in this case was done with the help of a multi-disciplinary team with user representatives involved throughout the whole process.

Example 2, cable coating and a mouse

The second example is from a cable-coating factory where the documentation of the production was going to be computerized (Halonen, 2003). There was no problem with the coating that held a high quality.

The documentation was done on paper, which provided a quick and easy access to the necessary information for the workers. When some value was to be changed, the workers simply erased the old one and wrote the new value. The only problem was that this information was not accessible in the office. Therefore a designer was hired to enable

this feature. The designer was conscious of the advantage of involving users in the development process and a user representative was appointed to take part in the work.

After some work the designer presented a solution:

“The information system was Windows-based and the user interface needed the mouse to be used. The interface was quite unfamiliar to the workers and some of them had big troubles to use the mouse. This increased the difficulty degree so much, that a few workers refused to participate in to the piloting.” (Halonen, 2003: 35)

The workers were really good at coating cable but were not familiar with how to use a mouse. The mouse was a technique that was implemented because Windows itself needed it, not because it would help the workers.

When the workers realized that when they had to change one single value in a document in this new system they had to start from scratch and retype all the information they stopped using it. The developer/designer interpreted this as an act of resistance and put effort in training and discussions hoping that this would decrease the resistance.

Stuck in a material, Reflection on the first two examples

It seems that in these two examples the technique for the solution was taken for granted and treated as a constraint. The designers failed to recognise that these were designer-imposed constraints.

Both solutions use equipment common in office workplaces where the work revolves around text and figures. But the workers in the two examples deal with different kinds of artefacts. If we for a moment compare the computerized way of selling stamps with the ‘old-fashioned’ way where artefacts in the form of stamps and coins are handled we realize how much more work the computerized way of working is.

These designers chose to prescribe solutions that they were familiar with themselves, not solutions that suited the people that were to use the systems, i.e. they failed to identify the whole design space. Instead they selected one tiny bit and developed a solution within it. The reasons for this are not known but it is clear that by sticking to solutions that were familiar to the designers frustration is generated down the line by the users.

It is not easy to be creative and innovate new solutions even though this is the purpose for design. But when somebody is stuck in a material or solution this way, lacking perspective to even realize the difficulties it is a serious problem. Although the experience of material is important and very often it is that experience that can contribute to good solutions, the experience of design is even more important. Among other this means identifying design space and identifying the relevant constraints. In serious design this often even involves questioning the brief since it is simply an early attempt to define the design space.

Briefs normally define a few constraints that act as borders of the (preliminary) design space. Michael Schrage even claims that after the first prototype half of the initial requirements are obsolete (unpublished).

Constraint setting

Rittel coined the concept of *wicked problems* and showed that there are no definitive formulations to wicked problems (Rittel 1973: 160). All but the most trivial design assignments can be described as wicked. He showed that wicked problems have no definitive formulation and that there is no criteria where to end a design process. Schön used the concept 'problem setting' to show the need to set constraints during design work. Design is not a problem-solving activity but an inquiry into the future situation of use (Gedenryd, 1998: 156). When trying to make a 'good enough' solution the designer has to be optimistic and start with some idea, i.e. constraining from trying other ideas, at least for the moment. The setting of these constraints are crucial for the success of the design process.

“One of the most important skills a designer must acquire is the ability critically to evaluate their own self-imposed constraints ...” (Lawson, 1997: 91)

Engaging users

One approach to design work is to involve users in the design process in the hope that this will make the suggestions for solutions 'better'. As seen in the cable-coating example simply involving users is not sufficient to get a result that fits the situation. Designers must create “infrastructures upon which non-designers can express their creativity.” (Sanders, 2001) This creativity must be focused in an appropriate direction i.e. constrained from exploring the other directions. If users are presented with a too open question or task you will just find out what is 'top of their heads', i.e. what they come to think of first. And if the question or task is too constrained the answers will be predictable and uninteresting.

It is difficult to uncover needs and desires that may be unknown even to the user using traditional methods (Hanington, 2003:15). There is evidence that methods where users are involved in narratives and interact with artefacts can be used for successful exploration of the design space. Examples of this are series of video prototyping workshops (Mackay, 2000) and the visual toolkits used at SonicRim (Sanders, 2001).

Methods for user involvement are chosen and constraints are set by the design team's judgment. This is at the same time the strength of design work as well as its weakness. Good choices lead to better results faster and the other way around. The latter was evident in the second example. Nelson and Stolterman claim that “...designers can learn to make better judgments, but can not learn - *a priori* - the kind of knowledge necessary for particular judgments at the moment they

occur. Skills and competencies can be practiced and mastered, in support for future actions, but should not be confused as knowledge for judgement itself.” (Nelson, 2003: 184) And since “..design judgement cannot be separated from the designer..” (ibid) experience is of vital importance. All kinds of experience can be of use, like experience of different methods, material, being frustrated, being optimistic, etc.

Exploring the design space can be done by having users inhabit the space with design ideas that they find interesting. These are explored with jointly constructed video-prototypes, i.e. staged and videotaped visual representations of the ideas for solutions (Westerlund, 2003, Lindquist, 2004). Some of these ideas are normally judged as more interesting. Users and developers can experiment with these more articulated ideas using detailed narratives to see if they can be meaningful in their life.

The same methods can be used both for exploration and for experimentation but with different approaches. An experimental approach will need more powerful constraints than an exploratory one.

Since all participants collaborate in making the video-prototypes, as actors, directors or cameramen, the work leads to shared experiences where the understanding for all stakeholders’ views and skills grows. That is one reason why it is important to have a range of participants with different interests of the solution.

Example 3, innovative interaction

A group of researchers in Aarhus aimed to redesign an application (Mackay 2000, Beaudouin-Lafon, 2004) . They conducted a series of workshops together with users of the application. The users and the designers discussed the use of the current software and made low-tech prototypes of ideas that could improve the work. These prototypes were used in scenarios that were videotaped, so called video prototypes.

“Video artifacts may serve multiple roles in any design process. They capture not only the basic functions of the software, but also more subtle considerations of the software as it is used in real-world contexts. By recycling video artifacts, we can move between activities that stress the specifics of the interaction and those that explore the general principles underlying the design, integrating the two and bridging the gap between abstraction and detail.” (Mackay, 2000)

Thanks to this process the participants generated novel and appropriate interaction for the application. This interaction is a ‘post-WIMP’ (Window, Icon, Menu, Pointer) interface that separates “the data being manipulated and the tools used to manipulate it.” (Beaudouin-Lafon, 2004:19).

The purpose for referencing this excellent example is both to supply a happy ending to this paper and to prove that cooperative design with clever and conscious use of constraints can be successful.

Trick or Trap

Lawson identifies several traps that a designer can fall into during design processes (1997: 227). Some of them deal with simplifying the process by treating it as having one ‘right’ solution. I.e. the design space is just one point. But this over-simplification is a designer imposed trap or constraint.

One trick is to balance knowledge and curiosity. Rittel calls this trick an art: *the art of not knowing*.

“Part of the art of dealing with wicked problems is the art of not knowing too early which type of solution to apply.” (Rittel 1973: 164)

Note

1. The radio programme describing the new soft- and hardware for the Post offices in Sweden was ‘Jobbet’ sent in the Swedish Radios P1 Wednesday August 27, 2003.

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