From rationalization to complexity: evolution of artifacts in design.

Abstract
In this paper we analyze the relationship between design methodologies and the artifacts used in them. We give a brief historical perspective of the field and present some examples and preliminary findings.

Keywords
Interaction design, product design, artifacts, design methodology, design history

ACM Classification Keywords
H.5.2 User Interfaces: Evaluation/methodology; Prototyping.

Introduction
Our current line of work proposes the following question: What can interaction design learn from more traditional design areas, such as product design, graphic design and architecture? We have a particular interest in early stages of the design process where the designer develops sketches and conceptual prototypes.

In this paper we present some preliminary work that focuses on methodologies and artifacts in product design and their relationship with interaction design. One of our findings is the relationship between the
evolution of design methodologies and their effects on design artifacts.

**Effects of methodologies on artifacts**

We see that the highly formalized, rational, design methodologies of the 1960s tend to produce equally formalized artifacts, where there is an effort to make the design problem and solutions explicit in each step, aiming at a high level of control and reasoning for each alternative.

More recent methods, which are less formalized and work on a more implicit way, tend to produce artifacts that are closer to "rough data" instead of analyzed, filtered information. Designers use these artifacts in a tacit and intuitive way, which makes the process less rigid and apparently more effective.

*From reason to complexity*

A brief overview of the history of design methodologies is seen in Cross [5]. In it we see the stages of the scientific objects in the 1920s, to the scientific processes of design in the 1960s, to the denial of design methodologies in late 1970s and 1980s, finally reaching the "designerly ways" approach of 2000s (to the present date), which proposes that design is a discipline with it's specific methods and tools, different from scientific and artistic fields.

This evolution is in tandem with the transition from the modern to the post-modern schools seen in architecture and design.

The highly rational views of the modern movement, with it's two distinct peaks of late 1920s and again in the 1950s, are counterbalanced by the post-modern movement of the 1980s, which proposes a much more personal and eclectic approach to design. In the current situation we see more that just one predominant design "school", instead there is a wide range of approaches which form a complex picture of several possible design strategies [3].

A good example of the scientific approach to design methodology of the 1960s is the hierarchical approach presented by Alexander [1], which breaks down the design problem of a kettle into 21 specific requirements. In this approach, the work of the designer is made easier and put under control because each of the 21 problems can be treated independently and explicitly.

*figure 1.* Hierarchical breakdown of a design problem [1].

The opposite example to this methodology is proposed by Moggridge [8], where the designers follow a "pinball machine" pattern. As he describes: "The process does not look like a linear system diagram, nor even a revolving wheel of iterations, but is more like playing with a pinball machine, where one bounces rapidly in
unexpected directions." [8]. Instead of being unstructured and futile, Moggridge argues that this "almost random" process is actually the most productive.

This same evolution, from the rationality of the scientific approach of the modern movement, to the complexity seen in the "design as discipline" approach has some interesting effects on the artifacts used by designers.

Structured analysis to "raw data"
In the more "traditional" approaches to design, which have their roots in the 1950s to 1970s, we see highly structured and rationalized artifacts, such as requirements lists and comparative evaluation sheets. Examples of such artifacts can be seen in Löbach [7] and are presented below. The requirements list is a document with 50 requirements for hospital bed for children. The items in this list are, for example:

- Manufacture in series should be possible
- Consider adequate colors for children
- Should be stable
- Height of bed should be adequate for patient, doctor and other personnel
- Must have handles
- Etc.

![figure 2. "Pinball machine" pattern (in green) [8].](image)

![figure 3. Comparative evaluation sheets which show a drawing of the analyzed object, its dimensions and a predefined set of characteristics [7].](image)
As we can see in the analysis artifacts, such as the requirements list and comparative evaluation, there is an effort to make design problems very explicit. Each requirement tries to make each of the problems very clear in a verbal, precise manner. The comparative sheets list a wide array of elements and each product is distilled by the same set of elements, so as to make them comparable.

In the perspective sketches, even being initial sketches, we see that they’re done to scale. Another author who argues for this approach is Bonsiepe [2], who recommends the importance of exact drawings. “It is advisable to switch as quick as possible to scale drawings with exact measures. Only then it is revealed that the “drawings without compromise”, or drafts, can be misleading.” [2]

In contrast, artifacts used in more recent methodologies do not try to make every aspect of the problems explicit and precise.

For example, when gathering data it is common practice to do contextual research, which sees the user in its real environment, with all the noise and interference that happens in actual use [4] and to record that use by means of photographs and video. Another technique is the use of personal inventories [8], in which the user is asked to show what objects are most important for a particular task and to explain how these objects are used. In both cases, the resulting data is not easily tabulated for comparison or tabulation. The designers don’t try to reach a “quantitative” approach but work with the material in all of it’s richness and complexity.

Another example of these “unfiltered” analysis tools is the experience prototyping techniques, in which the designer tries to experience what it is like to be in the role of the user. A particular case of experience prototyping is called empathy tool, where the designer puts himself in the position of an user with some special condition (like a disability, or an elderly user) and tries to accomplish some tasks from that perspective.
Also when working to analyze and present problems and alternatives, modern techniques propose more freeform and complex artifacts.

One clear example is the use of collections of images on corkboards walls. These images present one or more aspects of the problem but don’t try to filter away all the other information. On the contrary, they give a very rich and complex picture of the problem as a whole. It is normal to group and create relations between pictures, but there’s no need to “label”, compare or quantify them.

Another example is the use of rough prototypes or props to demonstrate an idea. These objects don’t try to have precise measures or final finishing, but do try to depict what would be the end result of the process in terms of use, described by role-playing or by some annotation on the prototype itself.

Discussion
As demonstrated, more recent design methods try to work with the design problem doing much less analysis that more traditional ones.

This is in accordance with Cross [6] who argues that “expert designers are solution-focused, not problem-focused.” This means that they don’t try to do a thorough and extensive analysis, but instead do a rapid “problem scoping” and then move quickly to the generation of alternatives.

The question that we might pose is if these artifacts are generally more adequate and in particular to interaction design problems.

Maybe in areas that need a more technical approach, such as the design of industrial machinery or critical
systems, the level of control found in traditional methods is desirable. Then we might ask about interaction design for critical systems. Should it use methods that are frequent in interaction design or methods from critical systems?

Our line of research seems to indicate that interaction design would always benefit from more recent artifacts, due to its inherent relation to new technologies and innovation. Still, as a design discipline, it would follow the general rule and, according to the problem area, would use more or less structured artifacts.

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References

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