Industrial Design and Usability: Indifferent Neighbors?

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ABSTRACT

In exploring approaches for creating easy to use and joyful products, this paper reviews best practices of industrial design and usability and attempts an evolved user centered design methodology. This is based on assessment of advantages, shortcomings and mutually beneficial characteristics of conventional practices among popular processes of each field.

1. Introduction

The technological revolution produced artifacts for the consumer while disciplines like industrial design and usability that evolved thereafter and in that chronology brought them into the hands of the consumer.

Industrial Design successively initiated as well as refined products to be consumer driven. Usability principles were often needed to make them long term friends of the user and accordingly the term 'user friendly' emerged.

The Usability stream was driven by the science of cognitive and behavioral knowledge. Though ingrained with a user-focused philosophy, the scientific outlook of this stream sometimes drove it to a point where logic and analysis took the excitement of both creative design and new technology away.

Today the consumer being an important and participating element of the product creation process, there is a stronger need than ever before to satisfy not just the functional, physical and cognitive requirements of the user, but also their emotional requirements. The industrial design discipline has much to offer in this regard.

There is therefore a need to examine these two disciplines closer with the expectation that if the similarities, overlaps and gaps are understood and applied towards a unified goal of ease of use and emotional satisfaction, it could perhaps evolve the design model needed today.

2. Value Systems, Core Competences and Market Drivers

The core values of both industrial design and usability are similar. They both strive to serve the direct needs of the consumer and ensure that the human element is represented in a product. However, their core competencies differ considerably. While usability emphasizes on data driven design and the measurable success of user's experiences, the emphasis in industrial design is on creative design and the pleasantness of the initial and successive experience for the consumer.

Their range of responsibilities differs as well. Usability professionals on the one hand are responsible for designing ease of use into mainly software based products from a 'functional' and behavioral perspective, thus primarily getting users to achieve their desired goals. Industrial designers on the other hand are responsible for the functional design of the product as well as its 'form' based features (including selection of materials and textures), which also have an impact

on the emotional experience. Thus industrial designers are expected to exercise a lot of creative freedom in their approach.

Market pulls also significantly affect the design process for products. Characteristics that drive the buying habits of consumers often sideline the factors guiding the long-term usability of these products. The appearance of physical products is proven to be amongst the primary factors responsible for their sales, styling of cars and electronic products being prime examples. But in many cases, well styled products turn out to be disasters in terms of ease of use, which unfortunately users tend to find out much later after buying the product. In usability likewise, focus on long term ease of usage often sidelines the impact of its initial impression. Now since the buying pattern (sales) of the products is governed by the 'look and feel' of these products, while their long term usage (service) is governed by ease of use, this inherently leads to certain divergence in focus in the industrial design and usability processes.

It is this duality between 'sales' and 'service' aspects which holds some of the gaps we will see in the next section. Some interesting industry statistics on purchase versus lifetime costs elaborate this further. The take-home price of a P.C. is typically only about ten per cent of its lifetime cost. More than half of automobile-dealer profits come from servicing cars, less than a third from selling new cars (1). Thus, despite their history of difficulties with technology and non user centric products, consumer buying behavior is driven by the initial experience, the 'wow' of the sales angle versus the long term dependability of the service angle. However we know that in industry when it comes to new product development, sales and marketing, and not service is the driver.

3. Models and Methodologies

There are numerous methodologies used by industrial designers in order to arrive at innovative solutions. Given below are two such methodologies commonly used in the ID stream, depicted in Figures 1 and 2:

Methodology A (2)

1. Design Brief: Statement of intent, giving a broad and basic idea of the product to be designed – "design a digital camera for kids".
2. Product Design Specification (PDS): The PDS is a document that broadly describes the desired features of the product. Designers work with the customer and analyze the market to generate a list of requirements necessary to produce a successful product. Designers constantly refer back to this document to ensure the designs are appropriate.
3. Concept Design: This two-stage process of concept generation and concept evaluation involves drawing up several viable concept designs which satisfy the requirements of the product outlined in the PDS and then evaluating them to decide on the most suitable to develop further.
   a) Concept Generation: Designers capture their ideas for solving the problems listed in PDS by sketching them on paper. A number of techniques are used in the development of new concepts. At the end of this stage, the designer is ready with multiple concepts, each resolving multiple problems.
   b) Concept Evaluation: Once a suitable number of concepts have been generated, the PDS is used as the basis to choose the most suitable design. This is ideally done by a multifunction design team so each concept is evaluated from a number of perspectives. The chosen concept will be developed in detail.

4. Detailed Design: The chosen concept design is then detailed with all the dimensions and specifications necessary on a detailed drawing and prototypes are prepared. The designer works closely with the manufacturer to ensure that the product can be made.
5. Manufacturing and Testing: The product is manufactured, first as a test prototype and tested for all the important functions it needs to perform. Once proven satisfactory, the product is mass produced for introduction in the market and use by the consumer.

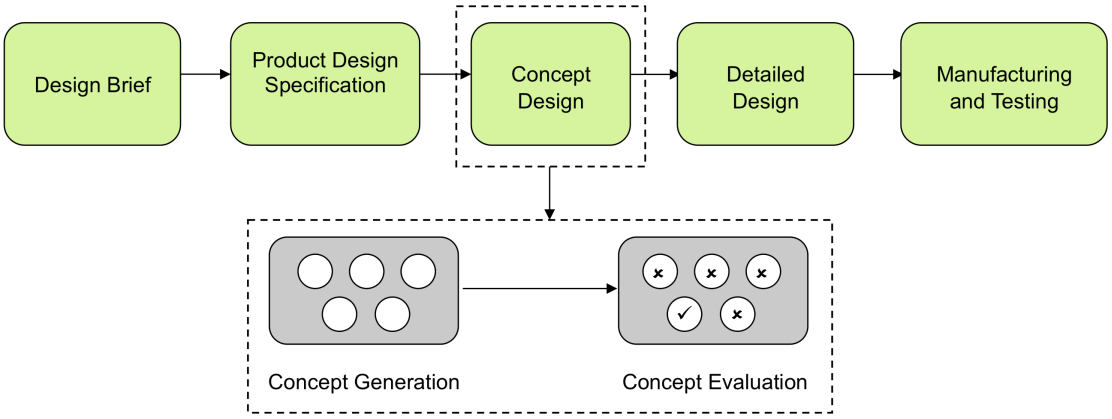

Figure 1 Industrial Design Methodology A

Methodology B

A variation of the previous methodology which differs specifically in the Concept Design stage is a 3 stage process:

a) Concept Generation: The designer generates multiple ideas for each characteristic listed in the PDS, ultimately preparing clusters of solutions in different directions.

b) Preparing Cluster Representatives: The designer chooses a representative from each cluster that is the 'best' amongst them or one that has multiple characteristics of each of the others.

c) Final concept realization: Mature concepts are evolved by merging characteristics of the different cluster representatives in different ways. A single concept is chosen after scoring them against all criteria mentioned in the PDS.

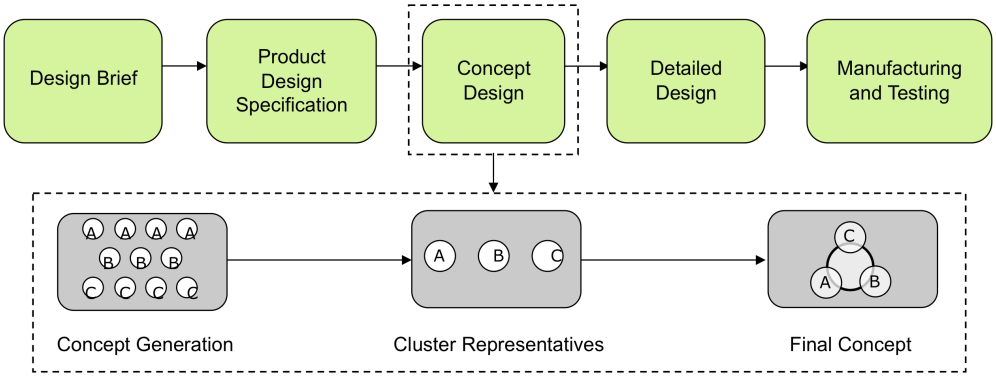

Figure 2 Industrial Design Methodology B

And the general User Centered Methodology of Usability used by User Experience practitioners is as shown below in Figure 3, where analysis is based on cognitive and behavioral knowledge,

design is based on this analysis and refined iteratively with user participation test, and thereafter the design is implemented:

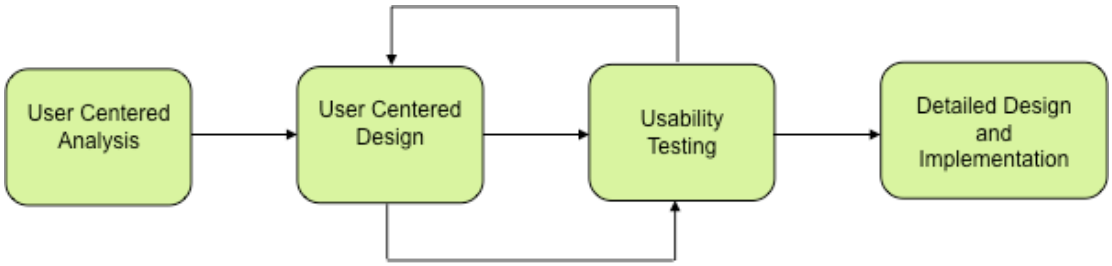

Figure 3 User Centered Design Methodology

A broad comparison between ID and Usability methodologies could be viewed as follows in Table 1:

Industrial Design	**Usability**
Analysis and Problem Definition	Analysis and Problem Definition
Creative Ideation	Developing Scenarios and Personas
Concept Selection	Concept Design
Concept Detailing	Usability Testing
Prototyping	Design Detailing
Market Ready	Market Ready

Table 1. Comparison between ID and Usability Methodologies

4. Overlaps, Gaps and Unification

Through the above models, we find the essence of both disciplines to be quite similar. Both are strategic and holistic and both approach the end product as a solution for multiple problems faced by users. Underlying each is of course an engineering /technology model that forms a basis for industry implementation. Both traverse a process of transformation, from requirements to concept design to detail design to build.

The essential differences are:

- ID emphasis on multiple concept generation as an outcome of free flowing and creative design undertaking and thereafter selection of one final design that synthesizes the best of all possible concepts.
- UE emphasis on a structured approach to arrive at one concept on the basis of user data and its successive iteration with users to validate it and minimize post release risks.

Differences also exist in the issues that these streams attempt to resolve:

- While in industrial design they are related to cleaning, transportation, ergonomics, form, task complication etc. of a product,
- In usability they would be related to navigation, interaction, layout, information architecture etc. of a software product.

Interaction with or observing users while performing the intended tasks form an important basis of the design process in both cases, though not necessarily to the same extent.

The resulting gaps, emerging from a focus on a single design too early in the usability stream, may imply inadequate exploration in a 'pure creative' and unconstrained mode. This may sideline the enjoyment and fun component of the experience of using the product, with the entire focus on the dependability (albeit with a high degree of confidence) of the experience. The creative design exploration approach on the other hand generates multiples of ideas and concepts using techniques such as Synectics and Semantic studies. This approach leads to key 'design thinking' capabilities that empower one with the ability to translate needs and requirements to creative and sometimes out of the box design concepts. These are key contributors of the industrial design approach often missing in 'typical' usability oriented approaches. Similarly, structured design validation in the usability processes that naturally give it the degree of confidence in its success is often missing in industrial design approaches.

But we know data driven design works. A confirmed 'easy to use' product or software rarely has user complaints after the product sale. However, we also know that ease of use without the excitement is passé. Today users' needs are for a joyful, instinctive and engaging experience. Their tolerance and patience for complexity is at an all time low. With increasing emphasis on cost savings, we cannot have the luxury of less than highest confidence in product success in the market anymore.

So there is a strong need for an approach that encompasses these gaps and addresses the duality of consumer needs and industry needs. Where's the golden triangle then?

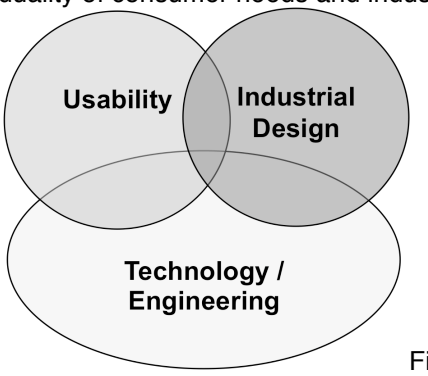

Figure 4. The Golden Triangle

The reason for a triangle is that the compliance with engineering and technology capabilities and limitations is a must. The golden triangle, as shown in Figure 4, therefore needs to combine the best of each of the two disciplines while being based on the engineering and technology foundations. It guides designers towards evolving not only a 'user-friendly' product but a 'refreshingly different' one as well.

5. Towards a Unified Education and Practice

Our education systems prepare us for a roles basis that often compartmentalizes our thinking to a point where, it is more 'specialized' than the best possible, as in this particular case. Therefore in

this case we need to synthesize some of the best practices and approaches of each to include benefits that each discipline can easily draw from the other, starting right at the education stage. We must coalesce into a more unifying and practical approach that helps designers arrive at products addressing users' needs at multiple levels.

The Usability stream could gain much from the creative methodologies of the Industrial Design field. Given the inherent complexity of software products and the limited understanding of users of the underlying technology, these methodologies could be used to evolve interfaces and interactions in very different contexts, such as:

- Consider the 'metaphoric' approach towards physical product forms (aggressive/playful/feminine), which basically cater to the inherent personality of the buyer/user, persuading him to buy the product just by virtue of identification of its character with himself. Similar approach could be adopted while defining the kind of interfaces for different users. Interfaces could be developed to specifically cater to the personality specific needs of different users.
- In a typical User-Centered Design process for a software product, rather than working on a single all-answers encompassing solution, ideation could be done separately on different aspects of the product. Developing multiple kinds of solutions for individual issues of navigation, layout, interaction, presentation etc. and finally merging the best out of them could lead to fairly innovative solutions.
- Developing new visual elements for on-screen interaction such as kinds of navigation menus, tabs, buttons, widgets etc. that are intuitive, as well as add an element of innovation and freshness.

The ID discipline through its teachings of emotion based design can also help differentiate between 'cute and entertaining' (nonsensical fun) that sometimes emerges out of new technology discoveries, while integrating 'pleasurable and enjoyable' (sensible fun), that adds freshness and joy to the design. Usability practitioners generally find such innovations from the software industry as not necessarily adding value.

We propose an initial attempt at a methodology for the Usability stream that incorporates ID principles as shown in Figure 5:

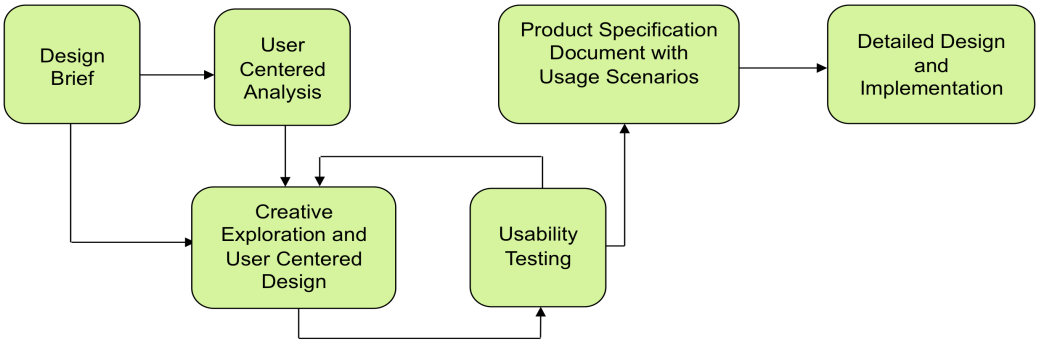

Figure 5. The 'Evolved' User Centered Design Methodology

Here, creative exploration towards richer design concepts starts from the Design Brief. The user centered analysis process feeds and helps refine the design concepts. Design concepts would emerge in greater numbers, evolve and get evaluated through usability testing. The Product Specification Document would be a live document that gets formulated as the creative exploration and usability testing processes finalize the design concept. It gets frozen with wire-frame designs and navigation defined, before implementation.

The industrial design stream could also add value to its innovative methodologies with inputs from the usability stream (4):

- Inheriting the structured user inclusive iterative design and validation process that ensures usage success to a great extent. Using this effectively, the ID stream could avoid generation of unusable but good-looking products that are primarily outcomes of the design process gone haywire; where excessive focus towards the creative or emotional aspect of the product leads to degradation of its usability worth to an unacceptable level.
- Focusing on the behavioral and cognitive understanding of the user groups in addition to the conventional 'usage' oriented study of subjects, in other words, focusing not only on 'how' users are using the product but also 'why' they are doing so, for insights into the design.

6. Conclusions

Creating a definition of a successful product is not easy. Ensuring that it emerges with the criterion for success defined is harder still. In viewing some of the differences and similarities between industrial design and usability, it seems both disciplines stand to gain from each other in addressing the needs of industry today where easy to use, fun and assured success in the market are all imperative. What we sell today is not the product but the experience with the product (5). We believe a careful merger approach of the above two disciplines can achieve this.

Involvement of designers in the usability stream has introduced some perspectives on 'experience' and 'pleasure' (6), which go beyond the functional-usage domain of products. Though this has initiated a change in perspective, an inclusive process view has still been missing. This paper attempts to elaborate on such a process.

Industrial Design and Usability are already neighbors; they need to become friendly neighbors by sharing and accommodating mutually beneficial features that would ultimately lead to evolution of each.

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