

# **Theory and Practice of Industrial Design**

**by Angela Dumas**

## **Abstract**

Design must be understood as a word that describes both a process and an outcome. It is the process of turning ideas into material things. The word design can be used with legitimacy in many activities, the design of a sales or financial plan, the design of a new organisation, or the design of a home construction project like building shelves. Many individuals have followed a design process in the course of their everyday activities. At some level, it is a natural human ability along with the other innate capabilities such as communication and language.

Industrial Design is the term used when the activity is pressed into service as a formal part of a business enterprise dedicated to creating artefacts as a part of wealth creation. Prior to industrialisation, individuals undertaking design were artisan craftsman, we might speculate on what expertise and knowledge those active in design might need in a future post industrialist age.

Currently, though, the activity of industrial design is generally linked to product development in a manufacturing context. It is a factor in the following:

- The creation of products that attain and reach beyond style.
- The integration and application of new technology.
- Activities that enhance or create new markets.
- Activities that enhance and guard brands.

Industrial Design is inextricably a part of innovation and it can make a contribution in the three broad categories of innovation activity:

- Incremental innovation – improvement.
- Variety innovation - styling/restyling.
- Radical innovation new capability.

The conditions for effective innovation include: good cross-functional communication and understanding; a base of shared knowledge and experiences and the ability to draw on the tacit knowledge of individuals. These are also essential requirements for effective industrial design. While industrial design is a specialist activity, the role of non – designers is critically important. Managers have always had a vital role to play in ensuring the effective use of specialists and it is no different with industrial design specialists. In relation to industrial design, managers must be the integrators across all aspects of the process. They must ensure

that there is effective communication between the specialist designers and others and that the environment is one of trust. Managers must be sure that there is a good fit with what is proposed by the designers and the abilities of the firm to make and sell the product through existing capability. Anything else has implications in terms of new investment and a manager must be sufficiently involved in early development to be able to consider a case for additional investment in a timely way.

Of course, design activity has an element of creativity, and this means that when a design process is triggered there will always be the potential for an unexpected outcome. New knowledge is built and can lead to new insights and provide challenges to an existing mind set. It is managerial skill that is required to maintain good trusting communication, keeping a project on track while not taking a damagingly narrow perspective.

It is helpful when thinking about the practice of industrial design to consider two levels of understanding. There are some broad aspects that should be understood by all managers - these are: to know the skill range of industrial designers; to know in what respects design and creativity differ; to understand in what ways industrial design contributes to the knowledge base of the organisation.

More detailed knowledge is useful, but it becomes essential if a manager will be directly commissioning new product development projects. This should include a thorough knowledge of the issues of managing design and a practical grasp of the phases of a design process such that an effective plan can be drawn up; finally an ability to manage well and to motivate others when there is a degree of ambiguity.

This amount of understanding across the organisation is necessary. Industrial design is just not effective if ring fenced and can lead to costly mistakes. One key reason why is because it is an activity in which many individuals across an organisation are involved. To this extent it is quite a diffused activity, there is simply not one simple activity that makes a finite contribution to new product development. When managed well, industrial design can be a rich and rewarding activity and can make a significant contribution to innovation. It is necessary to broadly consider the following;

- An industrial design framework or policy needs to be tailored to each company, it cannot be purchased, off the peg.
- Do not expect success from a design policy or framework, if there is no adequate structure to manage implementation.
- Do not expect industrial design specialists to understand the needs of the company, if the company has inadequate means to manage their integration.

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### **Design Definitions and the Origins of Industrial Design.**

Design is most readily understood in terms of tangible things, for example automobiles, computers, clothes, furniture, restaurants and shops. Most people use the word for both functionality and style.

We are less likely to use the word in its planning meaning, which is the first meaning given in the Oxford English Dictionary, where an entire page is devoted to the various meanings. A mental plan intended for subsequent execution is one definition, another is a preliminary sketch for a picture or other work of art. All the dictionary meanings imply process more than they refer to tangible things and many of the writers on design point out that design has always been a part of a larger process. Certainly this is true for industrial design where it is a part of a manufacturing process. This factor means that industrial design has changed over time due to changes in the socio-economic framework.

*“ Thus the difference between a seventeenth century pattern maker and a modern industrial designer is less one of their respective creative activities than of the economic, technological and social constraints within which the activity is performed” {Sparke, p.xx & xxi.}*

The creative aspects of industrial design are well explained in the following:

*The motor for a power drill, for example, may be substantially the same as the motor used for other tools manufactured by the same company. So the motor's shape and composition are fixed. The designer is responsible for the housing [the casing around the motor]. And the shape of the housing is not only functional but expressive: it must express the interior mechanism and delineate the purpose and character of the drilling operation. As artist in industry the designer is supposed to see to it that both form and material meet these requirements....Function itself is not devoid of this aesthetic consideration: part of any tool's function is to look like what it is”. {Caplan,p.126 – 127.}*

It is important here, to consider what separates industrial design from engineering design. The passage above enables us to think of some of the differences and indicates that there is probably some overlap. Engineering designers would have conceived of the motor for the power drill, so we can already see that communication between the two might be advantageous. The extent of engineering design can be described as follows:

*The development of a product from its technical conception through detail design, and the design of the related manufacturing process and tooling.*

Industrial design can be understood as a part of engineering design, or as running parallel to engineering design. However, when industrial design activity is engaged in the more aesthetic or style concerns of a product it can be understood as running parallel with marketing and brand activity. There is not a right or wrong answer here, but this is an important issue

because there is a lot of room for ambiguity and misunderstanding. Lack of clarity contributes to an ineffective use of industrial design.

We cannot rely upon the specificity's of industrial design and engineering design to sort out their differences. One reason for this is because of the different basis of their education which creates rather different approaches or mind-sets. Engineering is primarily taught as a science, industrial design is primarily taught as an art. The philosophical underpinnings are fairly diametrically opposed. One commentator has described the education of engineers as "educating scientists to research into engineering problems". He would rather see engineering as; "concerned with the design of artefacts". However, the split is sufficiently tangible that companies and their managers must manage the differences between the two, if they are to ensure good outcomes.

An understanding of the first use of industrial design in relation to modern manufacturing is useful, because we can then see how this specialism came into being. While the educational philosophy that underpins industrial design is in essence German, developed at the Bauhaus School in the early 1920's. The practice of industrial design grew in response to a commercial problem faced by US companies in the 30's. An article in the February 1934 Fortune magazine illustrates this well:

*"As a phenomenon, the industrial designer, came into being as mass production raised output to where one after another, industries hitherto without benefit of other engineering design found their products matched by other manufacturers and the market consequently glutted"*

In effect then the success of industrial design was predicated on its ability to help a manufacturer differentiate his product when the technology was no longer novel. And it created a form of product and market innovation previously unknown.

## **Industrial Design and Innovation**

Industrial Design is therefore a part of innovation. It makes its most significant contribution, as indicated above, in differentiation of similar products either by making them appear very different through colour and style, or by enhancing them with detail and minor additional features. In more radical innovation where new technology is involved, industrial design usually has a less central role because the novelty is provided by the new functionality. There are, of course, occasions where the new technology needs to be made more palatable to consumers and then the role of industrial design is more centre stage. An example of this is in areas of medical technology, perhaps where patients need to be re-assured about new machines and procedures.

If we return to the major contribution of industrial design, examples include the increasing variety in lap top computers, the increasing number of small consumer electronics for the home where colour and style are becoming the major differentiators. All increase market range and therefore consumer choice; they don't, however, create a really new market sector. However, a product that did achieve this was the "My First Sony" product. This product was a re-packaging of Sony products, for very young children. The Sony Walkman, was re-created in bright colours with larger and more robust controls. Other products, followed, but this created a new market niche in electronic personal products for very young children.. More of

a market innovation than a technology one, this is exactly the place where industrial design can be profitably employed.

In these ways the use of industrial design does make a contribution to economic performance and companies, investors and governments need to understand the importance of design spending for the innovation process. Design expenditure ranks with R&D expenditure as a strategic investment for companies, however, the lack of sophisticated techniques applied to design spending often holds back design investment. Project appraisal techniques and issues of finance and accounting methods need consideration.. For example, the finance techniques for valuing options used routinely in financial markets are rarely applied in the broader context. The benefits of design spending are systematically undervalued across companies and therefore the economy as a whole.

Decisions on new product development are rightly made at board level in companies. But many executives lack the knowledge of industrial design and this makes it difficult to create a common vision of new product strategy particularly among executives with different backgrounds. Indeed, the need for integration of knowledge is not often emphasised, with the result that a less than optimal strategy is frequently adopted.

### **Role of Non-Designers in Industrial Design**

The conditions for effective innovation include good cross functional communication systems and techniques to share and appraise knowledge and experiences. Also, a formalised way of enabling projects to progress from concept to completion such that projects that will not make the grade can be eliminated in a timely fashion. As a part of innovation, industrial design requires the same conditions. It is a mistake to understand industrial design as a discreet element, this is to only see that part of the activity directly undertaken by the specialists. It would be the same as if we considered that the concerns of money in a company belonged only to those people in the finance and accounting office. It is a general managerial responsibility to work to integrate the specialist designers and other requirements of the product. This should be understood as, being sure that there is a good fit with what is proposed by industrial designers and the abilities of the company to make and sell the product. So, on the one hand, there are the concerns of the designers, but also there are the concerns of the manufacturers and marketers. Each has a different, but equally, valid reality of needs and circumstance.

*“We believe there are in fact, more than two distinct design realities in most organisations. There are those of the engineers and the industrial designers, of course, as well as, perhaps, that of the ergonomists or human factors people. There are also the design realities of others involved with new product development, including people from marketing and manufacturing [or operations], and importantly, the people in general management. Each exhibits a different view of the nature, purpose and value of design” Dumas & Mintzberg 91.*

### **The Effects of Organisation Structure on Design**

We need to improve the integration of differing design realities, but the structure of most companies, in regard to industrial design makes this quite difficult

If industrial design comes within a marketing function and marketers buy the creative services of an industrial design consultant on an occasional basis for a special project, we will consider this quite differently than if industrial design is a part of the manufacturing function and we have a couple of engineers working in a small studio turning out tooling design on a day to day basis.

There are three main structural forms for design, one is where a single function has control, another is where there are separate design functions, usually industrial design and engineering, and a third where one of these separate functions dominates the other. A fourth form of structure, though not often seen, is where functions share control of design, for example, marketing and R&D.

The second form, separate design functions is often found in industries with the, “dominant designs” of Abernathy and Utterback, these are mature product types whose attributes time has stabilised so that producers conform to standard configurations – the ball point pen, the automobile, the VCR and increasingly, perhaps, the laptop computer. Here, the structure is decomposed into functions of design. This makes it simpler to manage an ongoing series of modifications – to make one brand or product a bit prettier or a bit faster etc. In the dominant design industries and the car is a good example, basic design remains stable, and so the different designers know more or less what to expect from one another, and can thus get on with their work, largely in isolation, thereby being able to enhance their specialisations and re-inforce their particular design reality.

This model is often quite comforting to both designers and managers but it is not a model that encourages real innovation. Innovation tends to come out of the separate chimneys. Nevertheless, this form of structure has created some very successful enterprises and should not be entirely dismissed.

In the past, when the flaws in this chimney model were first identified, some firms tried an alternative. This was to decide which aspect of design was the most important and to cede power to this group. For a while Ford tried placing industrial design in the dominant role with the industrial designers, or stylists as they are often known in the car industry, developing the initial design with other designers in engineering having to conform to it. However, the reverse situation is probably more often seen, where engineers dominate and the industrial designers are bought in to wrap the engineers’ product in some kind of pretty skin that ensures that the whole thing ends up being attractive and, “user friendly”.

On balance, making one design group dominant over another unbalances the design reality, and is therefore unlikely to be a sustainable model for success. It is a structural form that is best avoided, because as problems become evident in initial design, the only recourse is to throw them back over the wall for redesign which inevitably results in costly delays.

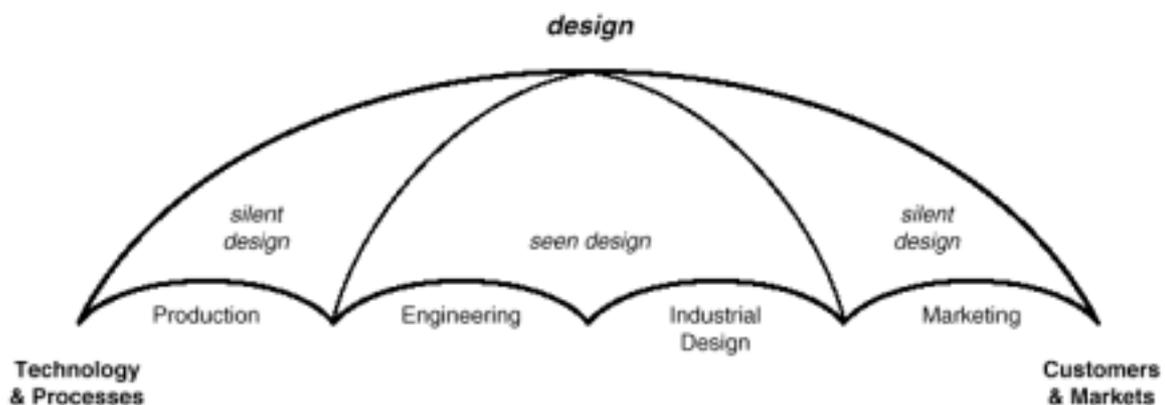
## **Structure and Integration of Design**

Since there is a general move in all industry to flatter, less hierarchical structures and an emphasis on team and cross functional working, the potential to integrate industrial design is quite real. To achieve integration it is essential to consider what we might refer to as a co-operative design structure. In this situation the absolute structure of the company is now, less influential because a commonly held design reality spans all functions. In this design reality,

industrial design specialists are respected for their particular capabilities and in turn, these specialists respect the design expertise of general managers. It is these managers who are hands-on designers of product-market fit.

In this design reality, design is not understood as a particular activity undertaken by a particular individual or function. Rather more it is understood as a sort of umbrella. Under the centre of the umbrella are the specialised design activities, the functions of industrial and engineering design and since these are more visible, they can be referred to as “seen design” Beside them, still under the umbrella, are the activities of those in marketing and production who are linking needs of manufacturing processes and the purchasing customers. Holding all this together is the general manager whose task it is to ensure appropriate levels of co-operation among the various specialised functions and the broad fit of product, process and context. All these activities, where managers take decisions on design in the stream of their other decision making can be referred to as “silent design”.

See Umbrella figure



Conceived of in this way, design becomes not simply one activity in the new product development process but the fit of all activities that affect the performance and appearance of the product. It thus emerges as a means to explore and manage various dimensions of design and its various interfaces so that several different realities blend into one integral product.

Adopting the umbrella metaphor provides a fairly unobtrusive way of introducing improvements in industrial design activity as it does not require a protracted period of organisation change. Further, the likelihood of producing an improved product quite quickly is high, which in turn boosts morale and motivation.

Dealing with different realities of design may be uncomfortable initially. But once integration starts, a common design reality can be rich and rewarding and interfaces that were once problematic become opportunities.

### **How Much Should Everyone in the Company Understand About Design?**

In helping everyone to contribute to an integration of design activity under one umbrella, everyone needs to understand some basics about design. This should begin with a senior management team and then be cascaded upwards and downwards.

- Similarities and differences between design and creativity
- Company “know how”, new knowledge and design.
- How existing mind sets can be challenged by new design knowledge.

### *Design and Creativity*

Design and creativity have certain things in common but they are not the same thing. The early stages of creativity are characterised by the existence of rather fuzzy implicit ideas, plenty of divergent thinking, a tolerance of ambiguity and the use of intuition. Also there is the need for experimentation and iteration or re-thinking. In the early stages of design, ideas quite rapidly give way to the creation of a strong concept or common vision which is tested out for feasibility. The later stages of creativity see more precise and explicit ideas, a tendency for convergent thinking, with a greater use of analysis and a concern for tests that prove consistency. The later stages of design move into considerations of capability, in issues such as production and market and customer acceptance. We can see that the early stages of design incorporate both stages of creativity while the later stages of design incorporate only the later stages in creativity.

The majority of individuals have the capability to be creative and as a consequence have a contribution to make to design processes. But it is worthwhile to remember that the differences in styles of thinking can affect where someone can make a contribution most comfortably. There are two broad sets of preferences in styles of thinking, a preference for facts, history and experience, or, a preference for metaphor, imagery and intuition. People for whom the first set is preferable are more comfortable with aspects of explicit knowledge in measurement, controls, processes and specification. People who are attracted to the latter set are more comfortable with implicit or tacit knowledge in discourse, ideas, ambiguity and emergence or evolution. To achieve a well balanced industrial design process both aspects are essential.

It is overly simplistic to consider that the majority of industrial designers come from the implicit knowledge camp and that the majority of engineers come from the explicit knowledge camp. Just as it is overly simplistic to consider that managers are not creative, in reality any organisation will have a mixture of thinking preferences.

However, what does require consideration is how to make the maximum use of the knowledge in the company. Encouraging individuals to give voice to the products of their imaginations is important. Imagination is a mental faculty that is improved with use and while we all think we know the meaning of the word, it is useful to consider this definition. Imagination is: *the “mental faculty for forming images and concepts not present to the senses”*. For a company to value this skill in its workforce is a significant step in improving design capability. Particularly if it is coupled with the use of insight which is: *“ a rapid mental activity that recodes relationships and enables one to see from a different perspective”*, and therefore be open to new ways of thinking and acting. *Imagination* and *insight* form significant tools in the creation of new knowledge and new designs.

## ***Company Know-how and New Knowledge and Design***

In their book, *The Knowledge Creating Company*, Nonaka and Takeuchi maintain,

*“the new product development process happens to be the core for creating new organisational knowledge”.*

Organisational knowledge can be described as:

- The deep knowledge that provides an organisation with core capabilities, in other words, know-how.
- The processes that provide for, “the way we do things round here”.
- The selective absorption of new things from the external environment that feeds into a value system.

If we now consider the many ways that a company might use design we will be able to see more clearly the sense of the Nonaka and Takeuchi statement. The following list is fairly comprehensive:

- To repackage existing brands
- To restyle existing products
- To ensure functionality in user interfaces
- To reduce component complexity
- To generate radical applications for technology
- To imagine future products and markets
- To evolve manufacturing processes
- To create prototypes for testing

As we undertake any or all of these things we create a good deal of new knowledge. Some of this knowledge gets codified while the rest is tacitly held knowledge that is almost impossible to document or put into a database. Nevertheless, we must understand that both filter into and around the company.

## ***Managing Existing Mind-Sets***

*“New insights fail to get put into practice because they conflict with deeply held internal images of how the world works, images that limit us to familiar ways of thinking and acting”.*

Peter Senge *The Fifth Discipline*

Earlier we considered the importance of creating a common design reality and while it is quite easy to commit to undertaking this it is more difficult to achieve. Techniques that enable open discussion are important, particularly to enable the more tacitly held knowledge to surface. This is because; *people with different mental models can observe the same event and subsequently describe it rather differently.* Their attention will have been taken by different details. Our earlier discussions of the use of imagination and insight is relevant here, because they help us to put ourselves in the shoes of others and this is essential if we are to benefit from the diversity that exists in our colleagues, customers and suppliers.

Diversity is positive if it is recognised, but when there are tacit assumptions existing below the level of awareness. Then situations arise where a group of people can believe they have

reached agreement only to find later that they were all agreeing to subtly different things. This is a hazard in industrial design projects, particularly the more complex type of project involving different specialisms and chains of suppliers. A particularly challenging situation exists when the common design reality must be established across different companies engaged in fabrication of components of the same product.

The management writer, Professor Dorothy Leonard refers to the problems of mind-set in her description of “core rigidities”. This is the circumstance where the core strengths of the company cease to be strengths because they have not been subject to review and change over the years. Suddenly the company experiences a failure in an arena where it has always performed well. Even the strengths of a company must be subject to regular review and company practice adjusted and kept up to date.

There are many programmes in existence that help a company review its practice in innovation process and product quality. However, industrial design is not adequately integrated into these. There are not the same programmes for industrial design and arguably, if there were such programmes, it might not make sense to adopt another formal review procedure, as they all prove expensive in terms of management time.

A mind-set that is intent on reviewing and measuring every aspect of management process is as problematic as one which believes that nothing should be reviewed and measured. It makes sense therefore to adopt a simple mechanism for reviewing industrial design practice and to search for a way to dovetail this into the formal regular process review mechanisms that are already in existence. In the following section we consider a way to approach a review of industrial design practice and how to use this approach to target areas for improvement.

### **A Good Mechanism to Review and Improve Design**

Starting with some general points, firstly, **it is important to keep in mind the overall purpose of a review**. A review assists in making the future better by learning from the past and actively anticipating the future.

In industrial design overemphasis on the measurable elements, for example, the number of change notes per project, can prevent appraisal of the soft issues such as good communication. One group who are experts in benchmarking manufacturing and development noticed in a study they made of measurement of product design that it is relatively easy to slip into the trap of only using the classic measures of productivity, cost, quality and time;

*“A tidy, structured development project may look great on paper-but if this is because debate has been stifled, there may be a high price to pay elsewhere”*

This group also took into consideration the communication across functions and overall market success. They found that an orderly product development process was not a particularly good indicator for market performance. They, however, caution that this does not imply that a disorderly process is more likely to yield success!

A statement on the context of industrial design is a necessary starting point. The following statement encapsulates the approach in this document.

*Industrial design includes actively imagining and anticipating the future. It can start with identifying customer needs or a market opportunity or it can start from new scientific or technological knowledge and an analysis of the opportunities such knowledge might be capable of creating.*

*It involves a complex system of decisions often made by different individuals with different mind-sets depending on their specialist knowledge and skills and within which function they sit in the company. The process is neither smooth nor linear. It is dealing with the new in a dynamic market and technological environment. It continually has to adapt and accommodate new information along its way*

## **Using Discussion Groups to Build Understanding**

Also when starting a review of industrial design it is good to have a set of open questions that can be used for a discussion to create a common understanding of the issues. The questions can be used with a group of people whose tasks broadly touch on development. This group should be as cross disciplinary as possible – do not exclude people responsible for finance!

These questions are broad, but the focus should always be maintained around the subject of industrial design:.

- Are the criteria used in industrial design consistent with the business strategy goals?
- How are the decisions co-ordinated?
- Who is responsible for ensuring co-ordination?
- Is the customer experience of products consistent and coherent?
- Is customer perceived value being optimised?
- What will be the expectations and values of our customer base in 5 or 10 years?
- How might our product lines have to change?
- What will be the impact of new technologies?
- Who is responsible for anticipating the future shape of our products and services?

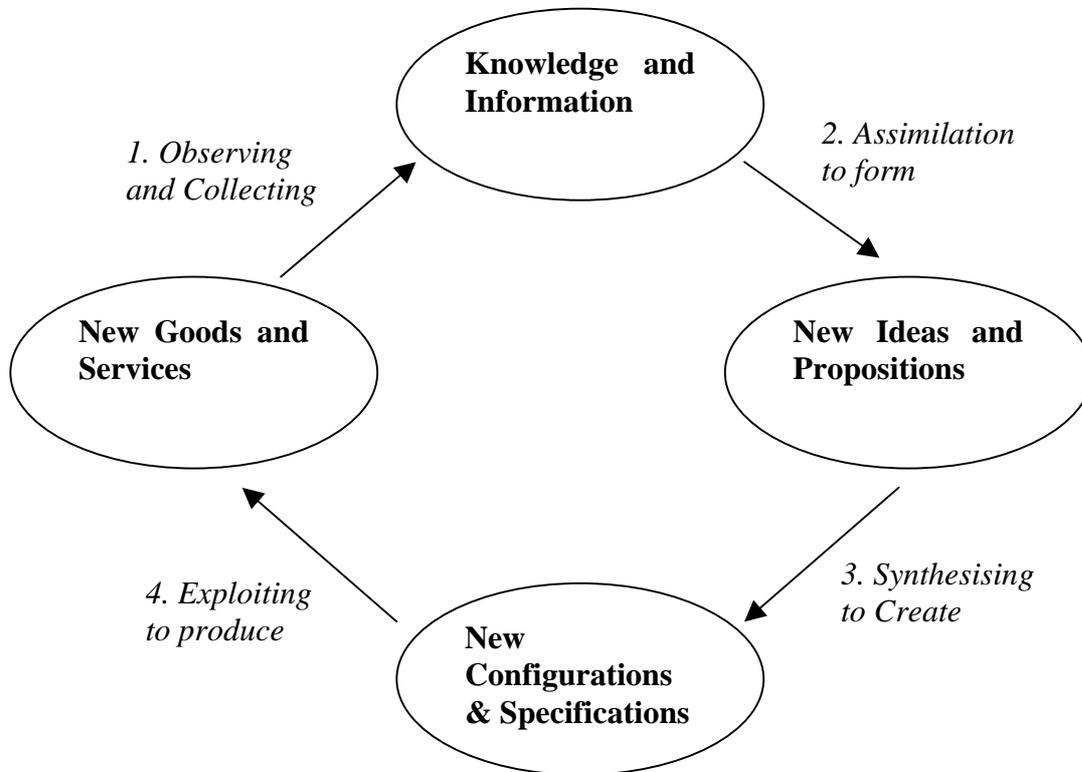
## **Introducing the Sequence of Design Framework**

As the discussion continues there will be many instances where differences of opinion arise. Remember that diversity is a good thing, if it can be acknowledged and the differences of opinion explored and valued. It is important to record the range of the debate. Even from a broad level of questioning such as these questions above, a group might gain insights on what improvements could be made. But these insights will be made more useful if some time is spent using a simple diagram that looks at the sequences of activities in industrial design..

This next step is helpful in enabling individuals to see how they make their own contribution to the entire industrial design process. A diagram, is merely a device to help structure thoughts and analyse them and is helpful both, to audit existing practice in industrial design and, to consider improvements.

The following diagram can be used in discussion as an aid to thought. It approximates what occurs during an industrial design development sequence. As it happens it also approximates much of what occurs in the creation and manufacture of product. This is not surprising since we know that industrial design, even if it is in the hands of an external consultant, is a part of a larger activity.

## Sequence of Design Framework



The diagram has eight elements, four elements we will refer to as, *output points*, and four elements we will refer to as, *process tracks*.

The four output points are:

- Knowledge and Information
- New Ideas and Propositions
- New Configurations and Specifications
- New Goods and Services

All these refer to a tangible outcome that can be witnessed and discussed, they are not the same in nature, but they all share a physical presence, even if knowledge and information is in stored data or reports, and goods or services are distributed and sold.

The four process tracks are:

- Observing and collecting
- Assimilation to form
- Synthesising to create
- Exploiting to produce

All these refer to a process or a series of processes. They are often quite hard to accurately locate and measure because they can be undertaken in the stream of other activities, which is particularly so, in the case of the first two, where there are many non designers .

The contribution to industrial design activity made by the non design managers and specialists, should not go unrecognised merely because their contribution is harder to measure or to pin down.

It is for this reason, that so much emphasis is placed on discussion. The diagram is best used by small groups of individuals working together to share their own experiences, insights and opinions. The sequences may be discussed in any order and a group may limit themselves to discussion of only a couple of sequences at any single session. The statements outlined below provide a direction for conversation and discussion .and they also provide an indication of best practice.

### **Managing the Discussion Groups and the Purpose of the Statements**

A company may need to have a number of parallel discussion groups. If this is the case, it is important to be sure that there is broad company representation in each group. It is also vital to plan debrief sessions when all the groups make presentations to each other, of the work of their discussion group, and , look for the commonly held values and conclusions.

To start the work of the discussion group it is useful to read through all the statements set out below to give a broad context and to help provide an understanding of what, in principle, falls within each sequence. Thus enabling groups to consider how, in their company, they achieve these activities in relationship to industrial design projects.

#### ***Statement One***

Typically, involves individuals in the functions of; marketing and product research and development who gather market, economic and technical data relevant to our industry and to our future products.. Or in smaller enterprises, individuals who undertake these activities.

#### ***Observation and Collection - to provide - Knowledge and Information.***

There is a way that the company gathers real feedback on how their customers feel about recently launched products. This includes, where appropriate, industrial designers observing customers using the product and asking them about their likes and dislikes. There is a format in the company that helps to present the experiences of the industrial designers in an accessible form. There is a formal way of presenting all other data, economic and market shifts, new technologies, in a balanced and accessible way. There is a mechanism, perhaps electronic, to share this widely across the company and also to suppliers and partners where appropriate.

### ***Statement Two***

Typically, involves the individuals in marketing and product research and development who are now joined by a wider group of people, who come together to form a cross functional team which includes, individuals who are specialist designers.

### ***Assimilation - a tangible way to see – New Ideas and Propositions.***

There is a way to recognise ideas and propositions , either in the form of a concept or another form that is appropriate to our company. Ideas are understood to be vital to long term success and assessed in terms of investment and in their potential to make a future financial contribution.. There is a way to store those concepts that are not immediately used so that they are accessible and cannot be easily forgotten or overlooked.

### ***Statement Three***

Involves the industrial design specialists who are now joined by a wider group of technical and process designers who together form a focussed project implementation team. It is likely that the marketers and others will now spend less time with the team but they may be involved in ascertaining early market feedback.

### ***Synthesising - to create options for – New configurations and Specifications.***

There is a formal way that all specification options that are created, are reviewed in an open and unbiased forum for their overall viability. There is a way to then assess these against the context of the current investment plan and business strategy. The options that are favoured can be tested with a wider group through the use of prototypes or similar simulation techniques. There is a mechanism for storing those options that are not taken forward.

### ***Statement Four***

Involves the technical and process designers who are now joined by a manufacturing project manager and representatives from logistics and distribution. Together, these individuals form the core team. Industrial designers are now in a lesser role, but may make a contribution on issues of packaging and presentation to the customer.

### ***Exploiting - to produce an efficient process to make – New Goods and Services.***

There is a formal way that industrial designers are involved in the assessment of the packaging process, for efficiency gains in packing on the factory line and in the end user experience of unpacking the product. Important criteria include, ease and economy of materials, adherence or awareness of cultural sensibilities in packing materials, and the maintenance of the right perception of the overall product value.

### **Taking the Work of the Discussion Groups Further**

With these discussions completed the next stage is to create versions of the diagram that are annotated to describe the industrial design process in the particular company. And to locate aspects of the activity with whatever mechanisms are currently in use to manage innovation

and product development. These might be charts, a series of project stages or gates, or some form of innovation funnel.

*It is important to keep in the forefront of the mind that the purpose is:*

- To identify where aspects of this industrial design development process, fit or are included within, the recognised and formally acknowledged processes of innovation and product development.
- To identify who carries responsibility for these aspects.
- To note those parts of the industrial design process that appear not to be in existence.
- To review the total situation, to be sure nothing has been overlooked, or simply described differently.
- To draw up a prioritised list of improvements.

The diagram, its output points, process tracks and accompanying four statements, assist in creating new awareness of industrial design. Helping individuals to see how they are a part of an industrial design process, even if they are not specialist industrial designers. There are no hard metrics involved, since this is much more of an introductory and self improvement framework.

There are accompanying set of questions that can be used to aid the discussion groups and these can be found in the appendix. There are, in addition, a small set of questions that will help in a review of a design function.

### **Situations to Use the Design Sequence Framework**

To see how a development team might make further use of the design sequence framework, in the course of a new project, we could consider the following scenario:

*Here a company has briefed an external design consultancy. They are a well respected manufacturer of traditional porcelain tableware. They wish to diversify, producing a small range of objects for the home that can be sold as gifts. The director for marketing contacts a well known industrial design consultancy that have offices all over the world.*

*A meeting is arranged at the design offices in London. Our company have never done this before and are a little apprehensive, they don't want this project to run out of control and therefore it is agreed that the consultancy will only produce some sketch concepts which can be taken back to Portugal for consideration in six weeks time. They will present the sketch concepts at the next meeting.*

*The marketing director returns from this meeting with the concepts. Now he is a little apprehensive, the concepts seem to run beyond what he had in mind – they have even included a table lamp made entirely from porcelain!*

The team uses the design sequence framework because, if at all possible they do not want to shelve the project and so they are hoping to gain some insights to help them proceed.

A design brief is a request for an idea or a proposition in a tangible form. It is therefore quite simply located in the second output point - New ideas and Propositions. The resultant

concepts from the design brief are a consequence of the assimilation of new knowledge and information. The Marketing Director used the knowledge he had gained in output point - Knowledge and Information to formulate his brief. To do this he had made an assimilation of the knowledge. However, he had not been able to include the consultants. The consultants, therefore had used an alternative knowledge base from which to produce their concepts. Of course the purpose of using external consultants is to gain fresh thinking, but their contribution will be more effective if it is grounded in the realities of the company.

They may still challenge the company for adopting an overly conservative approach to new product, but they will be better informed and the resulting discussion will have more meaning.

*The discussion group identifies the flaw in the second process track. They discuss how to include the consultants in the company knowledge assimilation process. They decide to invite one of the consultants to make a three day visit to see the factory and to meet the technical and process design team and to go through all the market research data.*

*In addition, they agree that if the consultancy wins the contract, one of their industrial designers will be required to spend up to three days a week with the company during development work to the point where there is an agreed set of specifications. This will prevent a similar mismatch occurring at the next stage. The financial implications of this are also discussed and agreed.*

*They look at the concept sketches again, they do seem to look nice and they are sophisticated but just too extreme, too much of a big leap in technical terms. .But they are confident that when the consultancy make their visit their will be plenty of opportunity for technical and aesthetic discussions. The group through their analysis of what stage had been insufficiently managed have gained some confidence and they now have a more robust process.*

Used in this way the design sequence framework can be used as a way to learn from on-going situations. This has the benefit of not taking time away from the real task of any company which is to continually improve and to create new products that delight customers and open up new market opportunities.

### **Benefits to Learning How Your Company Uses Industrial Design**

The Design Sequence framework can be used as a tool to help a company better understand how industrial design is currently used in the company. But, as importantly, it is a tool to evolve a more tailored well acknowledged framework that is unique to the company. The knowledge that is gained in this process can be used as an element that provides a capability and a competitive edge. This is achieved over time, as the industrial design process becomes clearer and more tangible, through concerted use of a device like the framework that helps individuals in the business of learning by doing.

Industrial design is, in certain respects, an ordinary part of any company that trades by adding value in the transforming of materials and resource into goods and services. Originally it was genuinely, albeit very simply, infused into the company. Now with the advent of so many specialists it needs careful, but not complacent, management to create a re-integration, one which does not overthrow the unique in an over hasty scramble for the new.

*“Managerial initiatives in all spheres, by emphasizing stilted policies, brief programs, and isolated functions, too often penetrate organizations when they should instead be permeating them..... some organizations are inclined to deal with every new issue by creating a new department, so that boxes proliferate on the organigram while problems fester. Perhaps it is time to re-conceive the process of management too, by recognizing that effectiveness comes from beliefs and attitudes that infuse an entire organization so that actions change throughout’*

Managing Design Designing Management  
Angela Dumas & Henry Mintzberg.

- **References**

“Industrial Designers” in *Fortune* magazine 1934

Caplan, Ralph, [1982] *By Design*. St Martins Press; New York.

Clark, Kim and Fujimoto, Takahiro, [1990] “The Power of Product Integrity”, in *Harvard Business Review*, November/December

Dumas, Angela [1988] in *Organization Transition and Innovative Design* in Clarke and Starkey

Dumas, Angela, and Whitfield, Allan, [1989] “Why Design is Difficult to Manage: A survey of Attitudes and Practices in British Industry” in *European Management Journal*

Dumas, Angela, and Mintzberg, Henry, [1989] “Managing Design Designing Management” in *Design Management Journal*.

Dumas, Angela, and Mintzberg Henry, [1991] “Form, Fit and Function”, in *Design Management Journal*..

Dumas, Angela, and Fentem, Andrew, [1998] “Totemics: New Metaphor Techniques to Manage Knowledge from Discovery to Storage and Retrieval. In *Technovation*.

Graham, Pauline, [1996] *Mary Parker Follett, Prophet of Management*, Harvard Business School.

Leonard-Barton, Dorothy, [1995] *Wellsprings of Knowledge*. Harvard Business Press

Nonaka, Ikujiro. and Takeuchi, H.[1995] *The Knowledge Creating Company*. Oxford University Press, Oxford.

Oliver, Nick, Gardiner, Geoff, and Mills, John, [1997] *Benchmarking the Design and Development Process* in, *Design Management Journal*

Polanyi, Michael, { 1966} *The Tacit Dimension*. Peter Smith, Gloucester, M.A.

Senge, Peter, [1990] *The Fifth Discipline: The Art and Practice of The Learning Organization*. Century Business, London.

Sparke, Penney, [1986] *An Introduction to Design and Culture in the Twentieth Century*. Allen and Unwin, London.

## **Design Sequence Framework Audit and Review Questions**

The questions or statements here are to help a group to structure a discussion on the four sequences so that they can gain a clear picture of company practice in each sequence. During the process of discussion they will be able to consider how things are currently undertaken and then to think about areas that could use improvement. The questions are not designed to generate any form of numeric measure. Moreover, they need not be used in the sequence that is set out below if the group feel that one particular area of development is giving cause for concern.

### **Sequence One**

#### **Observing and Collecting**

##### Question One

The company regularly looks outside itself, its industry and its existing markets for opportunities and ideas and has a way to log what is found.

##### Question Two

We regularly use both quantitative and qualitative research to identify customers explicit and latent needs.

##### Question Three

Our people are encouraged to get close to customers and use pro-active techniques to understand their requirements and observe first hand how they buy and use our, and competitor products.

##### Question Four

Systems are in place to capture customer satisfaction data from a qualitative perspective and the development team monitor this data and can recommend changes where appropriate.

### **Sequence Two**

#### **Assimilation**

##### Question One

We have systems in place to disseminate the results of customer research quickly to:

R&D

Marketing

Design

Purchasing

Manufacturing/Operations

Engineering

Distribution.

##### Question Two

We involve at an early point all those whose decisions may have an effect on product design or whose knowledge could inform the design development process {eg. Purchasing, finance, sales}.

#### Question Three

It is an early priority of a development team to create concepts for possible new project using concept development techniques that are inclusive and well understood across the company. A senior manager should act as sponsor or provide a mentoring role to include communicating the value of new product concepts.

### **Sequence Three**

#### **Synthesising**

##### Question One

Development teams carry a responsibility for assessing commercial and financial feasibility. The team remains together in some way right from initial concept phase until commercial launch. They are empowered to make decisions directly affecting design and they have an effective system to hand the project on to an implementers team.

##### Question Two

A new project proposition is documented in a clear and unambiguous way and the resultant design brief should try to have considered:

Objectives related to business strategy

Market demand and product life cycle

Consumer requirements

Competitor assumptions

Resource constraints

Innovation opportunity or potential new learning.

##### Question Three

Time is given to concept creation and a wide range of techniques are used to help generate and share concepts. Testing concepts is understood as a significant stage in development and various forms of prototyping are in use. At this stage prototypes are used to communicate thoughts and ideas and to generate new information. Any manager whose decisions later in the development process might affect the project are included in concept creation. These people may include:

Purchasing

Finance

Sales

Manufacturing/Operations

Distribution

### **Sequence Four**

#### **Exploiting**

##### Question One

Prototyping is understood as a significant activity and new techniques in cost effective prototyping are continually sought and explored. Prototypes are used to test the implications for manufacturing process as well as the product itself. Testing with potential customers for form, function and usability is always undertaken and the results documented. Any changes to prototypes are the result of careful consideration and are documented and communicated to all the development team.

#### Question Two

There is a clear and simple way of ensuring that a project that appears to be faltering does not linger. There is a culture which is focussed on the benefits of exploring ideas to prototype and there is no stigma attached to having championed a project that does not go through to manufacture. It is the responsibility of an individual in this situation to disseminate the learning gained from the project as widely as possible and in a short time frame and then to move on.

#### Question Three

Manufacturing and operations are well aware of the purpose of new products and any new features in an existing product. They understand how seemingly small changes can affect the integrity of a product. Individuals in manufacturing and operations are always on the lookout for ways to improve products through refinements in process. Quality assurance extends beyond technical performance to all aspects of a product that the customer experiences. Including; packaging, instructions for assembly and use, and after sales care and service.

#### Question Four

Any group of individuals who are in contact with the customer are provided with as much information as possible on; product function, features, care and maintenance, and availability. Wherever possible a way is found to enable them to understand the overall creative product strategy of the company and to be able to give their opinion and any insights they feel might be useful.