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Responsible Design

A New Design Approach

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Contents

List of Illustrations

Introduction

> Ethics constitutes an attempt to articulate and reflect on guidelines for human activity and conduct. Logic is the attempt to articulate and reflect on guidelines for human thought. (...) But what is it that articulates and reflects on guidelines for that intermediary between thought and action called design?
>
> Carl Mitcham (Buchanan, 1995, p. 173)

In an analysis of human motivation it is curiously easy to overlook the tenacious strength of the human search for meaning and understanding. To find identity and moral purpose or motivation behind aspirations is a challenge confronted by many in today's contemporary culture. Within the field of industrial design lies a labyrinth of directions. Absent however, is the illumination of a unifying ideology. Instead, a myriad of fragmentary ideals exists for developing designers to explore in their search for direction and purpose. This thesis marks the first step of my own, undoubtedly continuing, process of exploration. With the intention of learning more from the process than could ever be gained from the result, its aim was to formulate a design approach that I may build upon and aspire to.

Reaching an understanding of design often poses a greater challenge than the actual act of designing itself, yet both are inseparable with the progression of one dependent on the development of the other. It was hoped that from the writing of this thesis, the exploration of a design philosophy would improve my understanding of design, and hence

by extension, would influence my design activities, and possible future direction.

Design's direction as a whole lies within the framework of culture and this framework is currently changing in greater ways than just the constant surface motion that gives rise to fashion and fads. The underlying components of modern culture, such as demographics and attitudes, are altering and the role of design must alter with them. It is not enough just to change however, instead design must develop. To ensure this, we must question what can be expected of design's revised function. In what way should design alter to meet the changing requirements of society?

This thesis advocates an approach of responsible design incorporating the ideals of other directions, in an attempt to generate a foundation for a more complete design philosophy. It is hoped that such an approach would meet the increasing demands of industry and society as well as impel design towards that which it has the potential to achieve. It explores concepts associated with approaches such as User-Centred Design, Design for All and Green Design, reviewing the ideals contained within them, and identifying the realistic attributes of each.

User-Centred Design is a design approach predominant in ergonomic thinking, which also has a long historical background theoretically. It is based upon the premise that the formation of requirements and evaluation of decisions should revolve around the

product's comfort, ease of use and satisfaction for the user, and that ultimately, the user should be considered as the central aspect of the design process.

Design for All builds upon this concept. It promotes the idea of including the requirements of all possible users in the design process. The aim of this approach is to design products, services and systems so that they enhance the quality of life, and are equally accessible to the widest range of cultures, ages and abilities without compromise to any group. It is an expansion of the concepts of Transgenerational Design and Universal Design, which deal with the notion of designing for people of different ages and abilities. Impossible as these goals may seem, current demographic changes mean that aspiring to such ideals is not only ethically desirable, but it is also of benefit to a product's market share.

Another aspect that influences a product's market performance is the environmental impact of a design. The concept of Green Design addresses this issue. Concerning itself with the idea of minimising design's effect on various ecological issues, Green Design advocates that design decisions be made in accordance with the impact their result will have on the environment.

While each of these concepts presents a justifiable approach to design, individually they do not advocate a complete solution. Design should be centred on totality and synthesis, and for this reason, it is

desirable for a new direction which will consider all the aspects. This is the idea that forms the basis of Responsible Design.

Responsible Design revolves around the premise that design is a method of providing for society, and a means to enable its advancement. At the heart of this approach lies a concern for the effect of design's 'contributions' on the well being of people. It is about the recognition of real requirements, evaluating their relevance and satisfying them appropriately. Responsible Design is essentially about balancing priorities and the reasoning behind this activity. In addition to the traditional aesthetic and functional objectives of design, is added an ethical criterion.

This thesis explores the ethical role of the designer and questions the capabilities inherent in design. It investigates the extent of industrial design's influence on the aspects of humankind's well being and improvement, and questions what should be considered its greater responsibilities. Based upon an investigation of the purpose of design, the concept of Responsible Design revolves around three issues: real needs, accessibility, and protection of resources.

By no means is this thesis a comprehensive study nor are its results conclusive. Rather, it is an exploration. The beginning of an ongoing process that is itself, design.

Literature Survey

Upon beginning to research for this thesis, the possible sources of relevant and influential material seemed almost unending. In order to deal with this abundance of information, I attempted to explore a wide range of existing writings, which included well-known and obvious authors along with those less well known. Some of the pieces reviewed simply evoked thoughts or inspiration and others served as invaluable sources of knowledge, yet all contributed to some extent to this thesis, and by extension to my attitude towards design. This literature survey gives an account of some of the prominent sources for the information used in these chapters, but many of the writings referred to, have been excluded, only to be listed in the bibliography at the end of the thesis.

General Design Issues

Problems of Design, written by George Nelson in 1957 is a collection of twenty six essays reputed as one of the first contemporary efforts to deal seriously with the problems of the then emerging design profession. Nelson uses the word 'problems' in his title because his writings here put forward a set of questions which remain unanswered. These are used to explore the importance and curiosities of the design process itself. Nelson's thoughts and ideas relating to a range of topics such as, the nature of modern perception, and the designer in the

modern world are documented here, and this book provides an interesting portrayal of his evolving beliefs, enthusiasms and queries.

In 1967 Victor Papanek published the first edition of his book *Design for the Real World*. It caused a furore in the design community and the ideas contained within it were derided and savagely attacked by the design establishment of the time. In it Papanek put forward an account of design as a support to an economic system that controlled technology and products, and suggested where and why changes to this system should be made. Described in the author's own words as "the most widely read book on design in the world" (Platt, 1991, p. 56) it contained a jumbled collection of ideas which stake out a high moral ground for the designer to aspire to. It mainly proclaimed that design's only meaningful direction is to design for people's real needs rather than for their wants, and that designers need to take a morally and socially responsive attitude instead of simply perpetuating design's position as a marketing tool of big business. In order to correct the situation Papanek implies that a revolution in design theory and education as well as economic organisation is required.

In David Pye's book from 1978: *The Nature and Aesthetics of Design*, Pye puts forward his arguments regarding the many aspects that contribute to making a good design in an attempt to establish a basic theory of design. With a strong basis in aesthetics he questions function

and utility suggesting that design is always and necessarily an art as well as a problem solving activity.

Interpreting 'principle' as "a fundamental truth to be used as a basis for reasoning" and not as a natural law (Mayall, 1979, p. 6) W.H. Mayall, in his fifth book *Principles in Design*, puts forward ten principles of design. These aim to explain to the general reader the nature of design and why it is so important. Published in 1979, this book defines principles such as Totality, Value, Synthesis and Change, which are derived to be as appropriate to planning a town as to designing a refrigerator. Mayall attempts to clear away some of the confusion that surrounds the subject of design and throughout the book communicates an explanation of some of design's main aspects, implying a higher role for design and giving an inclination of the important elements fundamental to it. Written in descriptive rather than prescriptive terms Mayall's book conveys his view that design, like any other human activity, is an expression of ourselves and our aims, and with the book's final principle it suggests that design should satisfy everybody and not just those for whom it is intended.

In Victor Papanek's 1983 book, *Design for Human Scale*, Papanek explores what he considers to be the root problem to the products' and planned environments' lack of responsiveness to people's needs. Analysing the way design activity 'incorrectly' encourages consumption while ignoring cultural and ecological problems, Papanek asks how the

relationship with people can be encouraged in the design process. Where *Design for the Real World* attempted the questions of what should be designed and why, in this book, Papanek attempts to explain how.

In his book, originally entitled *The Psychology of Everyday Things*, but later changed to *The Design of Everyday Things*, Donald A. Norman makes a case against the occurrence of badly conceived and poorly designed everyday objects. With the intention of making the reader more aware of the problems and more interested in their improvement, Norman uses basic psychological thought and methods to explore the man – object interaction. In his book, Norman directs the blame for error and frustrations on the object and equips the reader with an understanding of the human side of this relationship.

James J. Pirkl was a key figure in the development of the ideal of Universal Design, and nine years after pioneering the concept of Transgenerational Design he published a book in 1994 entitled: *Transgenerational Design: Products for an Ageing Population*. Central to this book is the ideal that "human beings, including those who are aged, have an equal right to live in a unified society" (Pirkl, 1994, p. viii). In its writings, Pirkl gives an account of the demographic changes that are taking place in society and debunks common myths about ageing. He suggests alterations be implemented to the concerns of the designer so as to include the requirements of the elderly, and focuses on practical solutions to avoid discrimination against age or ability. His book

sensitises the reader to the needs of the elderly by exploring the effects of ageing and explaining some common functional impairments, as well as looking at a selection of product designs that are considered to enhance the quality of life for users of all ages.

Congress Papers

A number of recent congresses have illustrated the design community's changing view of itself and have demonstrated how designers are now discussing the powerful and far-reaching contextual issues that surround and shape their work. Of these congresses, two in particular have published books comprising of selected conference papers, which were of great relevance to the subject matter of this thesis.

Edited by Jeremy Myerson, *Design Renaissance* brings together a selection of papers from the World Design Congress of the same name held in Glasgow during September 1993. The overall theme of the congress was 'Renaissance' in the context of urban environment and the growth of new technologies for both products and communications, but the single most powerful theme to emerge concerned the ethical role and responsibilities of the design profession. Immersed in the light of ethical and political ideology, the collection explores the potential of the design process drawing from the congress' leading contributors, such as Stefano Marzano, Victor Papanek, Roger Coleman and Ezio Manzini. Encapsulated within a broad selection of views and debates, the series of

essays address the fragility of the human condition and the different ways in which design can work towards healing fractures in the environment and also the global economy.

In June 1994, the University of Art and Design Helsinki organised an international conference to focus on the responsibility of the designer, and on the sources of pleasure that design should offer. A selection of papers from the conference was edited by Päivi Tahkokallio and Susann Vihma, and published as the book: *Design – Pleasure or Responsibility?* This featured articles from designers and researchers from various cultural backgrounds such as Richard Buchanan, Victor Margolin, Wolfgang Jonas and Hans Kemp, among others. The selected articles offered new approaches to the controversial issue of pleasure and responsibility in design, as well as to design studies in general and were grouped in three sections. The first outlined new directions for advancement in design thinking, while the second and third sections dealt with: the users' experience and reception of design, and the relationship of design to crafts, respectively. Contained within the collection was a wide exploration of ideas relevant in today's design culture as well as for design in the future.

Environmental Issues

In the past decade, the contribution that design can make to improve the environmental situation has increasingly been recognised.

Much of this growing awareness has been due to a number of books written to deal directly with the topic.

In 1991, Dorothy Mackenzie published the first edition of her book *Green Design: Design for the Environment*, which set out the issues designers and manufacturers need to face in order to make environmental considerations a central issue of their design process. Examining a range of disciplines including architecture, packaging, interior design and product design, Mackenzie illustrates the different aspects of the complete design-to-production cycle of each. Avoiding a strong ethical stand, this book instead concentrates on providing guidance for those whose prime motivation is commercial success. Revised in 1997, the book's second edition took account of the activities in recent design and includes an updated selection of examples and case studies from industry to support its examination.

In *The Green Imperative: Ecology and Ethics in Design and Architecture*, Victor Papanek again demonstrates his passionate believe in the power of design to influence, and in this case he concentrates on its effect on the good or ill of the environment. Drawing on some material from his previous work, Papanek outlines the contributions which everyone, from the consumer to those at the forefront of design, can make to the well being of people and the planet. Backed with examples from packaging, product design and architecture, Papanek provides

practical advice and checklists suspended in spirituality and his typical ideology.

Collected Articles

The Design Management Institute Journal dealt exclusively with the topic of Responsible Design in its Fall 1991 issue. The volume aspired to bring the Responsible Design arena into better focus and dealt with topics spanning product safety, the environment, management of ethics, and legislative theory. The featured authors included Paul Burall, Birgit Helene Jevnaker and James J. Pirkl, and the articles gave a selection of thoughts relevant to the practical issues of design as a business as well as to design management and theory.

The *Idea of Design*, edited by Victor Margolin and Richard Buchanan in 1995, is an anthology of essays, which address the nature and practice of product design and graphic design in the contemporary world. The essays included are taken from the international journal *Design Issues* and focus on three themes: reflection on the nature of design, the meaning of products and the place of design in world culture. The diverse work is contributed by a wide range of design historians, scholars and educators, and conveys how the idea of design is explored in contemporary discourse. It presents examples of design criticism and theory, with occasional philosophical thought, which bear on the understanding and reflection of design.

Chapter One

Responsible Design

> Design is the most powerful tool yet given to man with which to shape his products, his environment, and, by extension, himself.
> (Papanek, 1997, p. 102)

Every person touched by design has pondered the question "what is good design?" and yet no conclusive answer exists. Philosophies such as those of the modern movement have put forward guiding principles, but today that ideological 'parachute' seems to be lost or hidden, and replacing it is a powerful concern regarding what the designer should be aiming to achieve. Ideas about the role of the designer, and the responsibilities of the design profession, emerge from diverse sources but the issue remains unresolved. Perhaps the whole idea of 'good design' seemed easier to isolate when there was more of a consensus about what constituted 'good' and 'design'. Our concerns must now be directed towards an understanding of what is requested from design; not what design is, but what it is for, and how this activity can be used responsibly. Perhaps then we can attain what may be truly regarded as good design.

Good Design and its Function

The fundamental function of design could be considered an application of intellect to plan and solve problems relating to man's

requirements. These requirements are based on a desire to advance, and it can therefore be deduced that design ultimately should be a tool to aid this goal. Good design then, in keeping with this idea, could be thought of as that which supports an improvement of humankind.

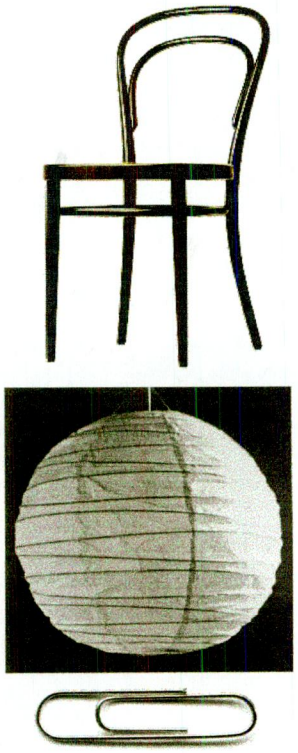
It could be argued that all design attempts in some physical or psychological way to improve people's lives by meeting their desires, helping them with their tasks, or providing a status symbol. These aspects alone, however, are inadequate if we reflect upon the potential intrinsic to design. Design should be expected to meet real requirements and achieve more for the user's well being as well as actively contributing to an improvement of humankind. In order to evaluate *how* good a design is, therefore (and a means for establishing a level for 'good') requires a set of objectives relevant to the greater potential of design. It is easy to say in theory that good design should achieve all the criteria expected of it. This would be the perfect result, and as all designers are aware, the achievement of such a solution in design is far from being possible.

> The requirements for design conflict and cannot be reconciled. All designs for devices are in some degree failures, either because they flout one or another of the requirements or because they are compromises, and compromise implies a degree of failure (Pye, 1978, p. 70).

While Pye is correct in suggesting that with compromise none of the conflicting interests will be properly or fully satisfied, this is only the case where compromise is evident. If all features of a product can

combine to satisfy all the characteristics expected of it, with an acceptable relative importance, it can be said that a synthesis is reached. The concept of synthesis avoids any evident compromise with conflicting requirements being resolved ingeniously, and almost magically, to create an optimal solution. This idea is referred to by W.H. Mayall in his book, *Principles in Design* as "the designer's principle" (Mayall, 1979, p. 90) and in many definitions, 'synthesis' is considered the essence of good design. "Good design comes from a totality of different principles, both functional and non-functional. It is a kind of fusion in the 'victory of synthesis' rather than the 'failure of compromise'" (Brown, 1983, p. 129).

Theoretically, a well-designed object should come naturally to the hand and eye, so to speak. However, an optimum solution such as this can often only exist where the conditions for verification refer to absolutes, or where the overall requirements are relatively simple. Many of the universally regarded items of good design such as Thonet's bentwood chair, a Japanese paper lampshade or the paperclip, are typically simple items. When fewer conditions have to be met, the designer has fewer compromises to try to optimise allowing a greater possibility of attaining a well-designed solution. This is not



(Fig. 1) Examples of 'good design': Thonet's bentwood chair, Japanese paper shade and paperclip

often the case in the role of the designer today who has to contend with the ever-increasing restrictions and requirements of modern industry. Perhaps, therefore, the most that can be expected from a complex product and its design is that the total problem, along with design's capability to solve it, be well understood. With such an understanding, the design process may then move towards achieving an optimum design.

How good this resulting solution is, can be judged on its appropriateness. In this regard, a product must not only be capable of appropriate realisation through manufacture and economy, but its very nature must be appropriate to all the human aspects that surround the product's complete life. The rights or wrongs of design decisions, therefore, cannot be judged solely by their immediate measurable effects, such as an improved sales curve or a price reduction. These are simply recognizable fragments of much greater concealed issues. A product's design can have a bearing on far greater things, such as independence or pollution, in both direct and influential manners.

Moral Purpose

Designers are constantly required to make choices between alternatives. For this reason, the fundamental capabilities imputable to design should form its foundation. The decision-making activities central to the design process should be based on design's primary objectives

and moral responsibilities. Instead however, "moral purpose has been reduced to whatever is popular in the marketplace" (Buchanan, 1995, p. 17). Movement towards products for the elderly, for example, is driven more from the purchasing power that this population group will have, rather than from the ethical necessity resulting from previous neglect.

Money is a substantial driving force in any industry, and this is particularly true in the world of design. Manufacturers and companies are primarily concerned with 'return of investment' and many even consider the sole purpose of design as a means to improve marketability. A Responsible Design approach does not exclude this aspect of design. In fact, it has the advantageous side effect of improving a products' market performance. For instance, where Design for All principles are applied, a broader range of people can use a product and it is estimated that a market share increase of approximately 20 percent may be gained (http://www.STAKES.fi/). Also, market awareness is increasing demand on manufacturers to be more ecologically minded, and therefore, Green Design will inevitably strengthen market positions. This is also true for design that makes greater effort to meet the user's requirements and improve their quality of life.

The Power of Design

Objects, to paraphrase Roland Barthes, have meaning beyond their practical function as signs and bearers of opinion, (Barthes, 1993,

pp 154 - 155) and design is the pivotal creator of these 'instruments of communication'. Designers have the capacity to cast ideas into tangible, enduring forms, which then become means to alter the way we think. Design is probably the modern world's most effective tool for communication and action towards change. With this comes an inevitable responsibility, which all too often, is unacknowledged by designers.

Design can contribute to people's hopes and desires or as easily to their tedium and despair, and a great many issues are touched by its cumulative effect. "Designers have played a key role in heightening the perception of the fragility of the environment" (Childers, 1994, p. 23). With their power to lobby, persuade and cajole, they may also influence other social and economic issues such as the discriminative treatment of the elderly and disabled or the frequent disregard for people's real needs. Can the problems of the world be *solved* by design? It would be naïve and pretentious to think so, but many of them could be eased by it.

As designers become more and more successful at addressing the questions put to them, the type of questions asked, and their relevance or importance in many cases, must be examined. Designers, by shaping our environment and influencing our future are, to some extent, accountable for it. A preoccupation with limited aspects, such as making things pretty or improving marketability therefore could be considered a

crime against humanity because it doesn't meet design's full capabilities or it's true responsibilities.

Design is ultimately a means to improve humankind and provide for society. To live up to its potential it should be aiming to improve the quality of people's lives now, as well as, enabling future development. If design is to provide for society it will have to identify and meet the real needs of the people, and it must to consider all the people. In addition, if it is to enable future development design will need to protect the resources currently employed as well as those which will (or may) be required in the future. We should strive for a design direction that will achieve this, and hence contribute to a world where we have not only material comforts, but a clear conscience as well.

Thinking in this manner, it is possible to identify three aspects, or requirements, that need to be further considered if designers are to aspire to the goal of creating good and responsible design. These issues form the topics for discussion in the following chapters and can be summarised in the following way:

- Meeting the user's real needs and improving the quality of life.
- Increasing accessibility and limiting product discrimination.
- Protection of what may now, and could in the future, be needed for our development.

Chapter Two

Users' Needs and Improved Quality of Life

> How many things can you do to enhance life, and how do you avoid those things, which do not? If there is a moral commitment – or an opportunity – for a designer, that is it.
>
> George Nelson (Bayley, 1985, p. 20)

Much recent design has concerned itself with the satisfaction of created wants and evanescent desires while people's genuine needs are disregarded or neglected. Design has played a part in a game of conspicuous consumption rather than being used as a tool with the potential to improve people's lives. Real needs have all too often been neglected while artificial ones are stimulated into an avid hunger for novelty, sensation, and status appeal. Products, such as mobile phones, behave as though they're items of seasonal fashion; with the next model under development before its predecessor has made the market shelves. Each 'improved' model comes with a new range of dialling tones or the added function of novel games, and still, as yet, no model adequately meets the imposed limitations of old age.

People's Needs

The identification of problems and resolving them, can be regarded as a main function of design, but in too many cases, instead of arising from people's needs, problems are incorrectly recognised, or even worse, are specifically created to be solved, and thus result in the

emergence of poor solutions. Often more effort is devoted to attracting the buyer than meeting the users' needs. Infant furniture or devices, for example, are frequently designed more for the fond grandparents who are the main purchasers than for the requirements of the infant end-user. It is essential that the strategy of a design process be better oriented towards an understanding of the structure of the users' needs.

The basic concept of need can be expressed as a state of unbalance that leads an individual to search for a means to resolve it to one of balance. Classic theories have divided needs into two groups. Primary needs are those whose satisfaction is essential for sustaining basic life, while secondary needs are "those that are born from the relationship among human beings and which are imposed by society on the individual" (Morales, 1984, p. 118).

Central elements to the concept of need are freedom and possibility. Freedom allows an individual to choose the means to satisfy a need and to improve their life quality. Possibility refers to the options at the individual's disposal. It is this that design should concern itself with, and a specific goal of good design should be to provide options, which meet one or more of the users' real needs and assist them in attaining an improved well being.

A person's needs usually stem from their desire for an improved level of life quality, and vary depending on their current status. As suggested from Maslow's Hierarchy of Needs, these needs can range

from basic human requirements for existence, such as shelter and food, to psychological and emotional needs, such as independence and ambition.

While the majority of the design profession's work is more likely to relate to meeting requirements of the latter types, the satisfaction of people's basic needs, for such things as clothing and access to water, should also be among the designer's concerns. Although it is doubtful that many designers will choose to address such needs in their activities, our responsibilities as designers must not exclude our basic and greater responsibilities as humans, which include a duty to those in need of basic help. For the greater part, however, the best that can be expected from designers perhaps, is a better understanding of design's role and capabilities, and that this may then contribute towards an improvement.

User-Centred Design

The quality of a person's life equates to the sum of their physical, social, psychological and economic well being. Design can influence it, therefore, by improving the safety, comfort, performance and pleasure of products and planned environments for people. This may be accomplished by two elements of a product's design: its functional ability; for example, improving usability by reducing or preventing inconveniences and frustrations, as well as its aesthetic attributes, which may increase the pleasure and positive emotions evoked by the form and

appearance of the object. A design that considers both will have wider success than one that only supports a very limited range of psychological responses.

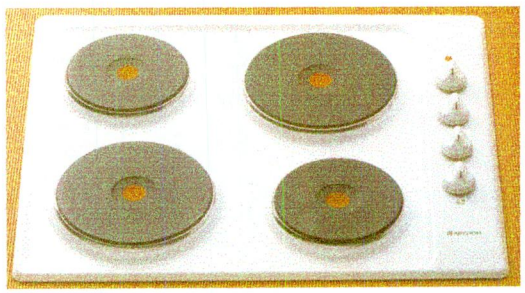
Design discourse has traditionally concerned itself with things (Margolin, 1995, p. 54) and needs now to be extended to include the user's relationship with the products they buy. If a product's functional performance is to be improved, objects should be designed to relate to the user rather than people having to adapt to products. The humanization of design centres on knowledge of the physical and psychological, capabilities, limitations, and real requirements of humans.

Some of this knowledge is to be gained from ergonomic science, which deals with "the study of relationships among human beings and the objects that surround them, providing information that can enable designers to avoid human problems" (Jevnaker, 1991, p. 49). By adopting its principles and placing the user at the centre of the design process, much poor design might be avoided. Notice, for example, the difficulties for a range of people, in the simple task of getting in and out of cars.

Usability

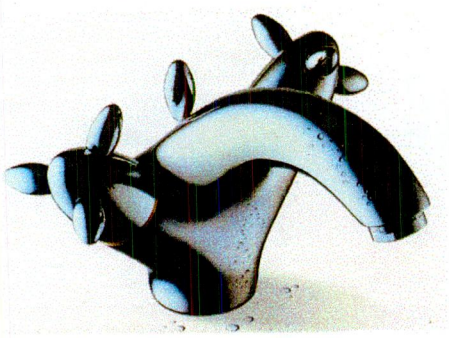
If design is to accomplish a User-Centred approach, products need to be designed for easy and uncomplicated use, with operations and controls that are logical and simple. Most well designed products are

easy to interpret because along with indicating mappings (usually visibly) between intended and actual operations, they provide crucial distinctions necessary to understand the object. From these clues the user can form a conceptual model to predict the possible effects of interactions with the product and it is this that is fundamental to their ability to understand and thus use the product (Norman, 1988, pp 1-13). The typical occurrence of placing cooker controls so that they don't clearly relate to the correct ring, is an example of neglect of this concept, and frequently results in misuse of the cooker.



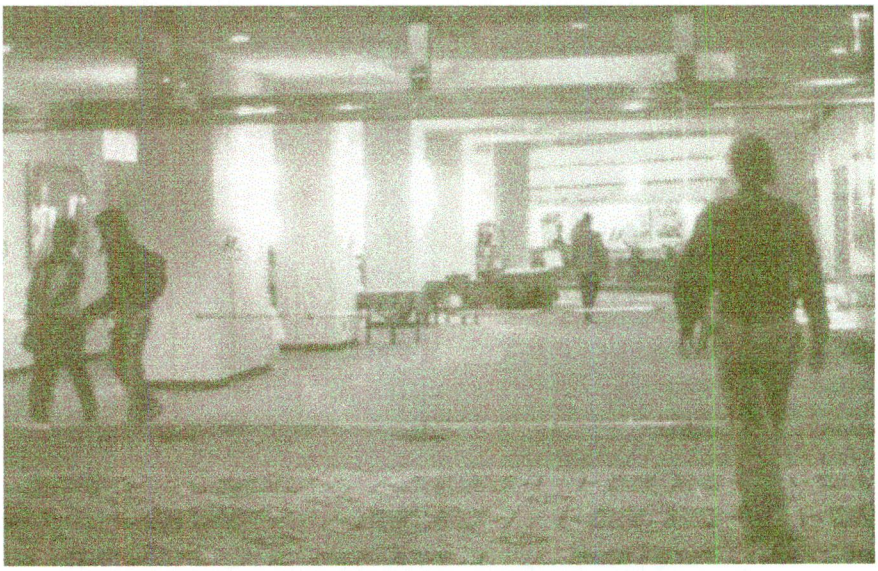
(Fig. 2) Cooker controls: showing no obvious relation to their corresponding ring

Correct use is more inclined to result if designers can employ the use of natural or artificial constraints to assist in indicating the operation of a product. Standardizing the knowledge required by the use of cultural restraints, such as left tap for hot water and right one for cold, or providing some kind of visual indicator, would decrease the possibility of incorrect use.



(Fig. 3) Mixer-tap: without a clear identification of hot and cold control

The recognition of how to correctly open a door, for example, can often result from obvious clues in the form of handles and push plates, or from more subtle clues, such as a visible indication of the hinged edge.



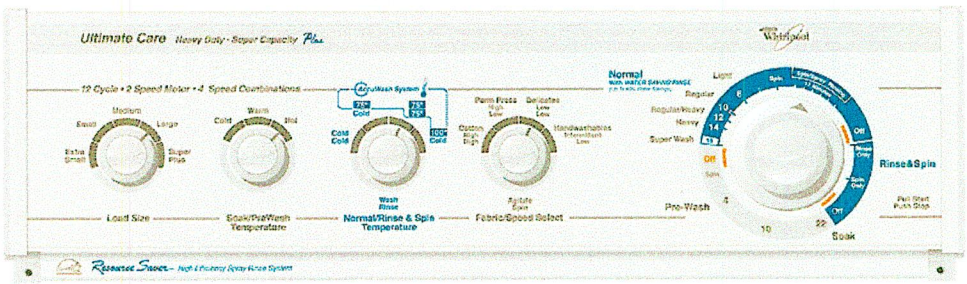
(Fig. 4) Set of glass doors that use subtle indicators

Handles positioned towards the centre of the door, visible hinge plates, and overhead dividers, provide the user with the subtle clues needed to correctly open these doors.

Use of indicators such as these, however, are not always correctly employed. How often could the embarrassing action of pulling a door that is opened by pushing be avoided? "Product forms that communicate their function and means of operation should be the first order of importance to designers" (Pirkyl, 1994, p. xi).

When the operations become more difficult, the designer needs to optimise the efficiency of learning. This may be achieved by limiting memory loads through simplifying the structure of the tasks, along with maintaining consistency to facilitate logical understanding.

The communication of a product to the user is the crux of a product's usability. The provision of feedback, e.g., visual display or tactile and acoustic feedback from a button, allows the user to gain information about the action that they have just performed. This will provide assurance, or notification of an error, as the case may be. A product's interaction with a person should be based on the user's knowledge, employing the user's language, so to speak. Controls that are task orientated are better, rather than relating them to the system's operation. An example of this is a washing machine's controls, which operate by clothes type and not programme type.



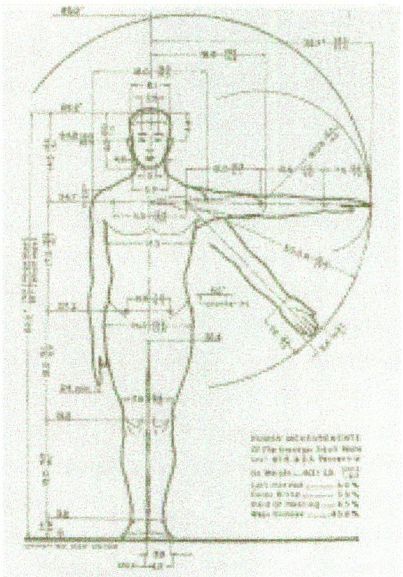
(Fig. 5) Washing machine control panel

In order to improve the usability of a product, designers should take into account how the product will *actually* be used and not just design for how it *should* be used. Designers become so familiar with the product they are designing that they can no longer perceive areas that might cause difficulties. A deeper understanding of the causes of errors would better enable their avoidance. An example of a product that uses this thinking is the common floppy disk which, although it has eight possible orientations, will only fit into the computer in the correct way.

On the other hand, the designer can also design *for* errors, acknowledging that they will occur. A product could be designed to make it easier to discover errors and reverse or correct them. Donald Norman in his book *The Psychology of Everyday Things* advises designers not to think of the user as making errors, but instead to think of their actions as approximations of what is desired (Norman, 1988, p. 131). Such an attitude would go a long way towards improving the chances of correct and convenient operation by more users. The convenient operation of a product relates to all the different areas of a product's life and all those who may use it. Wherever there is human interaction: storage, repair, cleaning, setting-up, operation and moving etc, consideration should be given to ensure there is as little annoyance and hindrance as possible.

Comfort and safety also need to be ensured if a design is to improve the well being of its user. Comfort is both physical and psychological, and apart from the actual body fit and avoidance of disturbing or distressing features and form, the psychological well being of the user should be regarded. The creation of space in a car interior, for instance, by the removal of the quarter-pillar, or in a lift by the use of mirrors, is an example of an improvement to the psychological comfort of the user. Noise, vibration and environmental factors such as illumination and thermal conditions can also effect a person's comfort and are all aspects that need to be regarded.

Designers often deal with these issues by referring to ergonomic data, but in many cases this is insufficient, as it doesn't consider the real user population or circumstances. In order to include a sizeable portion of the population as able potential-users, the 95th percentile data is often used. This is problematic however, as this information is not a true indication of 95 percent of the population. Firstly, the information is often not suitable for specific designs, only particular physical or sensory characteristics (e.g., length of arm, hearing). As a result, it is impossible to determine when a product can actually be used by 95 percent of the people.



(Fig. 6) An example of an ergonomic data chart

> Since people in the 5 percent tail for any one dimension (e.g., height) are usually not the same people as the 5 percent tail along another dimension (e.g., vision), it is possible to design a product using 95th percentile data and end up with a product that can be used by far less than 95 percent of the population (http://trace.wisc .edu/docs/30_some/ 30_some.htm).

In addition, the data from which the 95th percentiles are calculated often exclude people with disabilities (http://trace.wisc.edu/docs/ 30_some/30_some.htm).

In order to ensure improved design, the real user needs to be consulted as much as possible. Considering the difficulty to learn and memorise, efficiency, error rate, and subjective satisfaction of the product

can assess the overall usability of a design. Having an appreciation of varying user ability, both physical and psychological, as well as regarding the different ways that people may do things will inevitably increase the likelihood of improved usability. Often designers are unaware of the simplest improvements needed. A common overlooked factor, for instance, is the left-hand user. Sensitive planning, intelligent application of common sense and foresight during the design process are needed to produce a convenient and more 'user-friendly' product. As fixed solutions will invariably fail for some people, the solution may lie in flexibility.

Pleasurable Exchange from a Product

The functioning of a product is an obvious point of focus for enhancing a product's pleasure. However, the consumer's expected benefits of a product are very often divided into both utilitarian and hedonic/experiential. People buy particular products not only for utility reasons, but also for highly subjective reasons.

The competitive marketing of products up to now has caused design to make a greater emphasis on the *apparent* hedonic benefits of the items. Within the life cycle of the user's relationship with a product, much design has concentrated on the first impression stage, while the rest of the relationship; discovery of the product and its features, experience of use and ownership, and memory of the product, have been overshadowed. And yet, these aspects make a greater contribution to

the overall pleasure of a product than the initial attraction. It is in these areas that design can have greatest influence on the performance of a product with respect to its provision of pleasure.

According to Baudrillard, objects can meet four levels of exchange with a person: use value, exchange value/equivalence, symbolic exchange/ambivalence and sign (Morales, 1984, p. 119). A product, therefore, can also satisfy needs connected with the possession of objects. With many products part of the pleasure to be gained can be attributed to owner's wishes to communicate their social status and selected aspects of their personality. Through possession of different objects, the person attempts to find a place in the social hierarchy of culture (Morales, 1984, p. 119). If design overly concerns itself with providing semiotic means of communicating social status, this will distract from its potential. It would eliminate the remaining fragments of hope that design could be used widely as a tool to improve people's lives, and make a difference.

The psychological function of a product is rooted not only in possession, but also in the anguish that objects can ease by other means. Research undertaken by Philips identified there are four basic values that contribute to the pleasure in product use. (Kemp et al. 1995, p. 83). These are:

- A product's effective performance.
- The social context of the product's use.

- The history attached to the product.
- The sense of control the product provides.

From their research they found to improve a product's appeal, the design should enable a good performance and reliability. It was considered satisfactory for a pleasurable product to do what it was supposed to do efficiently, yet a high level of performance, or one that lasted for a particularly long time would be an advantage. (Kemp et al. 1995, pp 85-86).

One gratification a product can provide is obtained from a sense of control over the object. This can result from the traditional sense of being in control of the operation of the product, but also as an ability to revive the product after it has broken down. If the owner can easily repair a device, therefore, this would contribute to that product's gratification.

The use of an appropriate level of redundancy in a design solution may also improve the object's enjoyment by its ability to function better and for a prolonged period of use. It would mean providing a product with a functional capacity over and above that necessary for its intended use, making a product safer in the hands of the user, and allowing for its possible misapplications. The question here, however, is what should be considered an appropriate level of redundancy when users' imaginations will inevitably find many other applications beyond

those it is explicitly designed for? The modern myth of the women who attempted to dry her cat in the microwave is a good indication of what the designer is contending with. To resolve this problem the designer will have to anticipate a balance between users' imaginations and their prior conditioning which will constrain it.

This territory is a liability minefield formed around the legal theory of the 'least-reasonable-man', created to protect even the most witless user (Walton, 1991, p. 27). With industrial design often intended for use by millions of consumers who live in different countries with different cultures and varying levels of education and intelligence, the designer must tread carefully. The onus is on the designer to provide just the required level of efficient performance and to limit the likelihood of problems. Perhaps true user-friendliness will in fact remain an elusive goal.

A Designer's Duty

Who is going to make products that are socially necessary or desirable if they are not profitable? It is logical to expect manufacturers and promoters to direct their products to those most likely to purchase them. Design in fact cannot exist without commerce and business; it was conceived in industry and in artefact production. Unfortunately, most things are designed for the needs of manufacturers to sell to people, rather than the needs of the people. As Dieter Rams stated in a lecture

in 1983: "The spectrum of people's needs is often greater than designers are willing, or sometimes able, to admit" (Margolin, 1995, p. 55).

Designers have a duty to their clients, and often the moral responsibilities they should adhere to, clash with this. What should we expect of designers in such a situation? Papanek suggests in his writings that designers could decide what to design and why. Does this choice really exist for designers? Can they pick and choose based on a moral stand, or are most slaved to the pound? Even Papanek has to admit that, "obviously, few designers choose this socially rewarding but financially precarious option" (Papanek, 1983, p. 45). He also suggests alternatives for designers of withdrawing their talents from the market place altogether, or continuing to design blindly (Papanek, 1983, p. 45). However, these can hardly be entertained as viable solutions to the problem either. So what possibilities remain? Can truly responsible design ever happen without a perfect client, someone who cares and is willing to invest time and money into getting it right?

Rather than sitting waiting for this freak arrival, designers could contribute to the forming of more conscientious clients. The direction of design does not lie entirely in the hands of the client; it lies instead within the framework of the designer's relationship with them. This allows the designer to inform the client of the needs of the people whose business they are relying on. "Theoretically, speaking, the aim of the productive system is to satisfy social needs" (Morales, 1984, p. 118). It is in the

hands of the designer to be a mediator between the user and industry. In this way, a 'consumer requirement' led market might result, as opposed to one led by the manufacturer. Design is after all "the bias that helps things evolve. That is why design is one of the engines of civilisation" (http://www.presenceweb.org/results/body.html).

It should also be realised that the true responsibilities of designers, in fact, do not always clash with the ultimate goals of their clients. "If you address the wishes, needs, and aspirations of potential users clearly enough, people are willing to go to more effort to use the thing you design" (http://www.obstacles.nl/discussion/RietsemaJ.html). Therefore, they are more likely to purchase the product and this, after all, is one of the manufacturer's main objectives.

Chapter Three

Accessibility and Limited Discrimination

Design is first and foremost an attitude.
Roger Tallon (Bayley, 1985, p. 8)

It is difficult to deny that design should provide choice and that this choice should be extended to all members of society. It is in few real world situations, however, that this occurs. Design predominantly concerns itself with a 'target market'; a population segment which the designer focuses on, often to the exclusion of other possible users.

There may be nothing wrong with the design of, say, a Discman for the particular attraction of young adults. They are, after all, the main market segment and the most likely users. A well-designed product thought attractive by them will increase sales even if it doesn't appeal to the small groups of other potential users. But for many products, targeting may result in certain population bands finding themselves excluded from consideration in the design of many of the products they require. This can occur not just with regard to styling, but also in relation to the usability of the product. Obvious examples of such population segments are the older generation and those with impairments or disabilities. Products that are equally likely to be used by these groups are not always equally *capable* of being used by them.

A Changing Society

Design may be connected with making money, but it also has a responsibility to meet the requirements of as many people as possible. However, this has not always been achieved and currently that fact is being highlighted. As post war 'baby boomers', the largest segment of today's consumer population, grow older, it is becoming increasingly recognised that their requirements are not being adequately met by general design. The existence of a lucrative industry that produces accessories to supplement the shortcomings of original products and their design underpins this fact.

(Fig. 7) Assistive device for opening jars

Declining birth rates and longer life expectancies are causing a demographic trend towards an increased elderly population and a market previously dominated by the youth is finding its epicentre shifting.

- In the U.S.A. today more people are 65 years and older than the entire population of Ireland and Canada combined. By next year (2000) the world population of those over 65 is estimated to be more than 419 million, greater than the combined population of Japan, Brazil, France and Germany (Pirkl, 1994, p. 12).

- There has been a 50 percent increase in life expectancy this century (Coleman, 1994, p. 136). This means that the life expectancy for 1960 of 69. 7 years has now increased to one of 77 years (Pirkl, 1994, p. 15).
- Within a few generations the proportion of older persons aged 60 years and above is expected to increase from approximately 1 in 14 to 1 in 4 (http://www.un.org/ecosocdev/geninfo/ageing/ ageing-e.htm).

Whether considered a problem, or a triumph of the human race, these demographic changes demand that the requirements of the older generation be considered in the design of 'common use' and other products. They can no longer be discriminated against in the design process.

Despite the fact that over 94 percent of those over 65 years live independently (Pirkl, 1994, p. 6) designers will inevitably have to overcome and supplement the functional limitations that are associated with old age. Such limitations are not an exclusive characteristic of the elderly. A significant portion of the population has impairments, whether visual, physical, hearing or cognitive/language, which reduce their ability to effectively, or safely, use standard consumer products. There are over thirty million people in the U.S.A. with disabilities or functional limitations.

This includes those born with disabilities and whose abilities diminished during their lifetime through disease, accident or ageing (http://trace.wisc.edu/docs/30_some/30_some.htm).

Designing for All

In the 1970s in the midst of a growing awareness of the rights of people with disabilities, an architect and wheelchair user, Ron Mace, noticed how improved accessibility for the disabled usually meant better access for everyone and he coined the term Universal Design. This term encapsulated the notion of designing for people of all ages and abilities considering their needs equally. Others expanded the idea, such as industrial designer and gerontologist Patricia Moore, who at age twenty-five disguised herself as a woman in her eighties to personally confront the barriers faced by the elderly in everyday life. Universal Design is now a widely known approach, and one that has particular significance to current altering market trends. Its ideal has been defined as "the design of products and environments to be usable by all people, to the greatest extent possible without the need for adaptation or specialised design" (http://www.design.ncsu.edu/cud/pubs/udprinciples.html).

Should the mainstream design of products be expected to meet the requirements of all people including the consideration of the elderly and those with disabilities? It is easy to answer yes to this question from a humanitarian point of view. However, it is unreasonable and

impossible to try and design everything so that it is usable by everyone. It is equally ridiculous, however, to expect each product be specially designed for different disability groups. What then, might be the solution?

For many types of impairments there are simple improvements that could be incorporated into mainstream products which would significantly increase their accessibility and usefulness to individuals with functional impairments.

Working on the principle that people with special needs should not have to search for special products, Smart Design, a New York design consultancy, designed a range of kitchen utensils and gardening tools for people with limited dexterity to be produced by Oxo Incorporated. Originating from a need identified by Oxo's president Sam Farber, the company's *Good Grips* product range have large diameter handles covered with Santoprene, (a soft thermoplastic rubber) and flexible finned areas that form finger grips on the sides which respond to the pressure of the user's hand. These give the product a pleasant tactile feel as well as preventing the tools from slipping out of the hand during use, even when wet.

(Fig. 8) Oxo *Good Grip* handles

Though intended for use by people who may have difficulties operating conventional tools, the product avoids the stigma often attached to products designed for use by those groups. Their pleasing form illustrates that it is possible to bring the same level of visual quality to items for special requirements, and that it is even possible to blur the distinction between these and standard products.

(Fig. 9)
Good Grip
paring knife

The design makes an appealing visual and tactile virtue out of the products practicality, and the simple result is that they are equally suitable and enjoyable for use across a wide range of dexterity levels. According to Tucker Viemester, Smart Design's vice president, "they were designed to aid users of all abilities. Although the bigger handles are a requirement for some disabilities, they are more comfortable for everyone" (World Design, 1992, p. 156).

Accessible Design

The best approach to improving accessibility of design is a direct one, incorporating design modifications into the initial design so products are more accessible 'out-of-the-box'. This provides the greatest access at the lowest cost. "Incorporating disability standards at the design stage is cheap – amending products and standards or making specialist

provision is expensive, time consuming and ultimately discriminatory" (http://paperino.cselt.it/ufds/include/info/pam1.html). Sometimes accessibility cannot be provided directly, but the inclusion of features that make products easier to modify, or the availability of standard options or accessories may be possible. An examples of this is the Sharp *Carousel II* microwave which offers a braille overlay, for tactile identification of button functions, as an optional accessory.

(Fig. 10) Sharp *Carousel* microwave and control panel

In most cases accessibility can be added to a product's design for little or no added cost. Oxo's *Good Grips* handles are an example of this. The customising functions for improved accessibility included on Macintosh and Windows 95/98 computer systems are another. These various functions allow easier operation by users with various impairments and are implemented as an extension to the computer's operating system. *Mouse Keys*, for example, enable users who do not have the motor control needed to operate a mouse, to move the cursor via the numeric keypad. A *Close View* function allows the screen to be enlarged up to sixteen times its normal size, aiding visually impaired

users without the use of special add-on devices, while higher contrast display options facilitate easier reading. Visual warnings of sound notices can assist those with hearing impairments, as well as being useful in general for those users with no sound facility on their computer.

StickyKeys, another feature, allows users who have only one hand available, or who use a head or mouth stick, to execute operations that normally require more than one key to be held down simultaneously (e.g., control-g or alt-h). This is done instead, by using the keys serially. The facility deactivates when any two keys are depressed simultaneously, as can be done by a typist of normal ability, so it is transparent to users who do not need it. The other mentioned functions can also be set to automatically turn off if left idle for a set time, allowing unaffected operation by those who do not require them.

Benefits for All

In addition to ethics, designing a more accessible environment can provide significant economic benefit for society as a whole. The costs incurred from benefits paid, and loss of revenue, by individuals being unable to effectively function independently in the world as it is currently designed, could be reduced.

Consideration of disabilities and functional limitations in mainstream design is very definitely feasible from both an economic and practical standpoint. Items designed to be used more readily by the

elderly or those with impairments are likely to be beneficial to all users by reducing fatigue, increasing speed, decreasing the number of errors, or decreasing learning time. We will all, at one time or another, through injury or incidence, find ourselves in a situation where we could benefit from products designed for easier use by those with functional limitations. Ability depends on many factors, and apart from impairments, may vary due to age, gender, anthropometry, personality and attitudes, experience, or education. Many circumstances can limit our abilities, for example, holding something large can hinder movement, poor lighting can reduce visual ability, wet hands may effect strength of grip, and tiredness can alter psycho-cognitive abilities. Consider the advantages of having pavements ramped at crossings, not only for those in wheelchairs, but also for prams, bicycles, and delivery trolleys. Also, a phone's volume amplification controls; originally intended for those hard of hearing, can be of benefit to anyone using the phone in noisy surroundings, or on a bad line.

One aspect that may do as much to help resolve the current situation as it did to create it, is the attitude of people and designers. How old is old, for example? The arbitrary line that once separated youth from age is wavering. Bismarck's categorizing of 65+ set in 1860 hardly seems suitable anymore. Today's linear view of life; education - work - leisure, is more likely to be cyclical in the future with people returning to education and changing profession once or more during their lives.

Society, therefore, needs to recognise a new map of life, one in which the thirty years or so after 50 will be as important as the thirty before. This holds great relevance to designers who should be designing based on real lifestyle requirements not outdated life models and stereotypes.

A change of attitude and knowledge is required. If designers are to meet the challenge of accessible design, they will first have to understand the elderly and impaired not as sympathized homogenous groups, but as dignified individuals with needs and aspirations. Accessibility is also psychological. Will a person, say, with a physical limitation feel *welcome*? "Design has a vital role to play ... shaping a world that is user-friendly, flexible and accommodating, that adjusts to our changing capabilities as we age, and offers us a chance to adapt by remaining active and fit for as long as possible" (Coleman, 1994, p. 136).

How a designer perceives a user will dictate to a great extent the solutions proposed. In order to design for the general population, it is important to understand the diversity, problems, tools, and abilities of its members. The whole issue is not one of accessibility, in fact, but acceptance of human diversity.

Chapter Four

Protection of Resources

We do not inherit the earth; we borrow it from our children.
American Indian Proverb

The industrial idiom of design, failing to honour the principles of nature, can only violate them, producing waste and harm, regardless of purported intention.
William McDonough (http://www.lelcompany.com/cd12.html)

A few specific scares intensified with images of dying North Sea seals, statistics of depleting ozone layers and names such as Chernobyl, Exxon Valdez, and Greenpeace, stirred an awakening in the 1980s of the environmental situation. Today, not only is this situation still a concern, but awareness of it and consequent actions have increased. Customer and industry pressures, new standards such as ISO 14001 (environmental management standard) cost saving opportunities and competitiveness mean that environmental issues can no longer afford to be ignored in industry. Designers, whether motivated by personal ethics or following commercial pressures, must design to protect the environment and nature's resources.

Sustainability

Whether it is a use of resources, production of waste, or influencing nature's patterns, almost every activity (or, in some cases,

inactivity) of human kind, has an effect on the environment. Without fully realising it, the combined effects of many of these actions has turned man's relationship with Mother Nature into a definite concern and even a cause of agitation.

> One fifth of the world's population use four fifths of the world's resources. (...) Daily on a global scale, for every thousand new products that appear on the shelves of supermarkets, a hundred natural species perish forever (Pantzar, 1997, p. 54).

If humankind as a whole are to aspire to improve, or possibly even maintain our existence, the resources that we require now, and the resources we will require in the future, must be protected. To achieve this requires the care and preservation of all of nature, her acknowledged, and *unknown*, resources both material and informative. The possibility that cures to future medical problems, for instance, have been distanced from our grasp by the extinction of a plant type from the forests of South America, is not to over express 'green' doctrines. If one considers the wealthy source nature has been in the past, not only to the medical field, it is pretentious and complacent to think that we can allow its degradation. Can we really afford the extinction of species or damage to nature's resource?

Limiting mankind's effect on the resources we require is dependent on sustainability. This is the ability to organise human activities whereby, on a planetary and regional level, the ecosystem is not disturbed beyond its 'resilience', or ability to replenish itself.

It is now thought, to achieve sustainability in the future, we will have to live while relying on only 10 percent of the environmental resources that we are exploiting today (Manzini, 1997, p. 46). While only an approximate figure, it is a sufficient indication of the level of improvement that is required if we are to alter the current environmental situation.

Design's Role

In the past there seemed to be more questions than answers concerning environmental issues, and the pressure was on science to resolve the situation. Now however, as scientific understanding improves and reliable information becomes more available, the environmental spotlight is falling heavily on the designer. Previous utopian and apparently naïve ideals of people such as Victor Papanek or Richard Buckminster Fuller now emerge as rational and calculated parts of industry, and designing for sustainability is becoming an important element in the designer's role. But what can be expected of the designer?

Many environmental problems result from the production, use and afterlife of products (and services) and as Dorothy Mackenzie wrote, "The designer, as the principal determinant or creator of the product itself, has a direct influence on the amount of damage which will occur at each stage in the process" (Mackenzie, 1997, p. 11).

The ability to effect the current environmental situation will not only relate to the design and production of less environmentally harmful products, but it will also depend on the acceptance of these products and services by the marketplace. A new social attitude, possibly one of reduction, will need to be sought. The designer's skills will be invaluable in helping to develop products that are more environmentally friendly, and also in creating higher social eco-efficiency. To do this, designers need to contribute to developing new lifestyles based as little as possible on consumption of materials, energy and other resources such as water and land.

Unfortunately designers actions in the past have contributed to attitudes of the opposite nature. Creating new styles with increasing frequency and products with built-in obsolescence resulted in a 'Kleenex' – throw away and replace – social attitude. These activities now must be addressed and rectified if the environmental situation is to be treated.

Durability

One possible step is to make the consumption phase as long as possible by the production, and encouragement, of durability. "Design will have to develop products with the technical and also the cultural capacity to survive over time" (Manzini, 1993, p. 36).

Functional failure, newly available technical improvements, and fashion all cause product replacement. If products are to be used for

longer periods of time, the first thing they will need is the capability to maintain their functional performance. Designs that incorporate the possibility of 'upgrading' will contribute to this. Designing for easy maintenance, maybe by modularity, or facilitating the public themselves to do simple repairs, may also increase a product's functional life. Another consideration is the functional redundancy of a product. A greater level of redundancy would improve the durability of a product, as well as, meeting possible unknown future uses.

In addition to the functional aspect, the overall experience of the product for the user will have to persist if durability is to work as a solution. A new aesthetic will be required - one where products are more 'timeless' and less susceptible to fashion trends. The possibility of designing products to be flexible or easily modified could be exploited to allow variation over their life in an attempt to cater for changing tastes and fashions.

At the moment, however, it is doubtful whether durable design of certain products would be successful. Possibly more expensive than competitors, (though this need not actually be the case) and facing an unprepared market, even if these products were purchased, they may not be retained any longer. Shifting attitudes beyond the notion of possession and personal consumption to one of nondestructive utilization of products and services is needed. This would undoubtedly have to be a gradual change.

"Might we find potential solution of materialism by taking materialism one step further?" (Pantzar, 1997, p. 54). By learning to appreciate and cherish material possessions, consumers might do more to maintain them and keep them as long as possible. Just as televisions where originally sold as a new member of the family, might designers now aim to increase the emotional attachment to products in order to combat problems associated with consumerism? This approach would provide an interesting opportunity aesthetically.

Anti-Consumption

Another approach might be an extension of the ideas associated with the pursuit of *existenz minimum* similar to the first decade of this century in Europe and the anti-consumption ideas of the 1960s in the U.S.A. and Europe. Instead of originating from reaction to developing production and consumption, as the original ideas did, this new proposal would stem from the visible change inevitable in today's consumption behavior. If, instead of social quality being indicated by the possession of goods, it were a reduction of needs that expressed higher quality of life, consumption and the consequent effect on the environment could be reduced. Naturally, such a departure would have to be attractive enough to be freely chosen and couldn't correspond to a scenario of deprivation.

Perhaps this could be a new application of Mies Van de Rohe's 'less is more': a new design approach expressing the richness of less.

Are designers powerful enough to induce the acceptance of such a concept? Might the pretext of 'style' be its patron?

Anti-consumerism cannot realistically be regarded as a valid suggestion independently. It is less likely than other alternatives to be accepted for the very reason that design, or at least many designers, depend upon it. Industrial design originated from a role of increasing marketability, and some today even seem to think its sole purpose is creating desire for products. To propose using design to reduce the market, and the very energy of purchasing, therefore, does not appear to make much sense, as it is sure to meet opposition. Only if a well-structured strategy were developed where demand for design existed, in some other form perhaps, would there be any hope of the implementation of anti-consumerism. This would require being able to do business while producing less, and the material flow of products to slow but the speed of innovation and progression (as it should) to increase. While anti-consumerism alone cannot offer a definitive solution, some of its attributes should nonetheless be integrated into designing for sustainability.

Will durability itself be a solution? "In reality, the degradability of matter is a necessary premise for development" (Mangiarotti, 1997, p. 74). This is not to say that development will not continue regardless, just at a reduced rate perhaps. Rapidly replaced goods, in the past, allowed rapid advancement of technologies. In many cases, this technological

advancement is needed to find answers to environmental problems. Philips 26-inch television, for example, was developed in the early 1970s and the energy consumption of the product at the time was 360 Watts. Through innovation in the late 1980s a reduction to 90 Watts was made, decreasing the environmental load substantially. In this case, if durability had been promoted in the 1970s a higher burden on the environment overall may have resulted. Today, there is few remaining ways of innovating to reduce energy consumption of the television, so durability now poses a viable and interesting challenge (http://doorsofperception.com/doors/doors4/transcripts/cramer.html). Less technological innovation is likely to result from longer product life; consequently, durability is only a sensible option where this reduction has least effect.

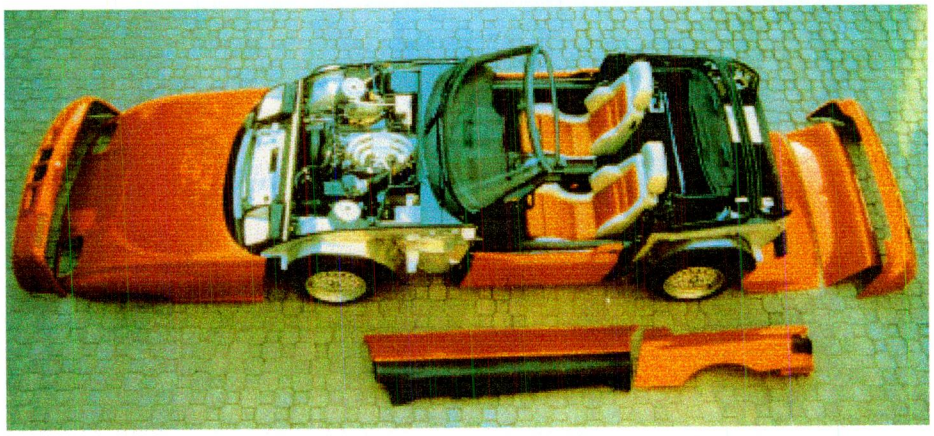
(Fig. 11) Philips 26-inch television

To reduce a product's impact on the eco-system, designers will have to decide and communicate, for each particular case, an appropriate action to optimise full usage of that product. This may be achieved by extending the product's period of use by durability, but it is also achievable by extending the lifetime of the product through other means, such as, recycling or remanufacture.

Design for Disassembly

The extension of the product's life after its usable period can be encouraged by Design for Disassembly (DFD). This will facilitate the convenient separation and sorting of constituent parts and materials for reuse, repair, recycling or upgrading. Such an approach must be integrated in the design process from the early phases to be practical, and may dictate many of the design decisions. Parts and assemblies would have to be simplified and fastening methods such as screws, glues, welding and rivets; would need to be replaced with two-way fasteners such as 'pop-in pop-out' rivets. In general, assemblies would be required to snap apart as easily as they snap together.

Designing things that, on the one hand, have to be durable and on the other must come apart easily might seem something of a paradox, and yet BMW are proof that it is a practical consideration. Their *Z-1* two-seater has an all-plastic skin that can be disassembled from the metal chassis in less than twenty minutes.



(Fig. 12) BMW's Z-1 sports car: with recyclable thermoplastic panels

This limited production sports car has doors, bumpers, along with front, rear and side panels made of a recyclable thermoplastic. The company also has a disassembly plant at Wackersdorf in Germany where it cuts apart a number of standard cars each day to learn new take-apart technologies (Papanek, 1994, p. 32).

Easy disassembly methods, in addition to quicker initial assembly, have the advantage of allowing repairs and maintenance to be much easier. Agfa Gevaert have developed a modular design for their copiers which enables them to upgrade key elements and replace worn-out parts, extending the life of the product and improving its marketability.

Design for disassembly could well be an origin for a new design aesthetic in future years. A possible move beyond it may result in more products being sold disassembled, like in kit form, for assembly by the user or someone else, in a similar fashion to some furniture today. While this would be more difficult for the designer, it would be cost effective, and would provide an interesting aesthetic and marketing plot.

DFD, however, is a very demanding approach as it requires less 'forgiving' parts and closer tolerances in connectors and joints. To be practical and economic DFD must be considered as part of a much larger scheme that will incorporate reasons for easy disassembly, such as recycling or remanufacture. There is little point designing a product to be easily disassembled with the intention of recycling if the material obtained cannot be recycled economically.

Design for Recycling

Design can have a very real effect on the recycling of materials. Separation, sorting and identification of materials can dictate the difference between it being considered economical or not. For example, copper is extremely difficult to remove in the steel recycling process, and a mere 0. 2 percent of copper can cause severe cracking in the recycled steel reducing its value substantially (Burall, a.1991, p. 57). Reduction in the number of different materials used and prevention of contamination of potentially good material are the main considerations in assisting recycling. Many precautions are not inconvenient if the designer is aware of them. The use of an alternative material, for instance, in some cases can enable practical recycling. In the above situation, for example, aluminium, which is easily removed from steel in the remelting process, may have been used instead of copper.

Another aspect is the easy identification of materials for sorting. This may be helped by visible branding or possibly by incorporating built in tracers within the material. Toxic materials, especially, need to be easily identified so they can be removed before the product is recycled. Design for recycling is one of the few areas of environmental design where information is actually available, and application of this knowledge by the designer may mean the difference between efficient reuse and waste.

An example of design conscious of recycling is the Zanussi *Nexus* range of washing machines and dishwashers, which have structures based on five modular sub-assemblies. A large percentage of the structure and components are molded from carboran, a recyclable advanced polymer, while fewer individual parts, snap-on fixings, and modular wiring, also allow easy dismantling for repair and recycling (Mackenzie, 1997, p. 72).

(Fig. 13) Zanussi *Nexus* washing machine

If recycling is to prosper, there must be a market for the resulting material. Here too designers can assist by considering recycled materials during material selection. The performance of many recycled materials, for example steel, aluminium or glass is no different to that of the virgin material, though some plastics are of a lower grade and limited colour choice. In general[1], recycled materials are a more environmentally sound option. Not only do they save on the waste that would otherwise have to be disposed of; they are also more energy efficient to produce than the virgin material. Recycled glass uses as little as 25 percent of the energy for first time glass, and recycled aluminium can cut energy costs by up to 95 percent (Burall, a.1991, p. 56).

[1] Some processes, such as double chlorine de-inking for recycling paper, is as damaging as virgin paper production.

It is unrealistic, nevertheless, to think that all products can be recycled for materials. The complexity of some products will make it too difficult, and others, such as small electronic devices, may have only small quantities of materials, making recycling impractical. Remanufacture is an alternative consideration, and may even be a better choice, for some products. This concept refers to the reprocessing of complete components after their use. The remanufacture of engines and other parts in the automobile industry has now reached the point where they are indistinguishable from virgin components. BMW, for example, consider the needs of this afterlife procedure in the original design process of their cars, and they remanufacture components for the spares market as well as for use in new cars (Burall, 1990, p. 35).

Complete Process Consideration

Each phase of the design process has an impact on the eco-friendliness of a product. Material selection is critical not only in a direct manner, but also in that it contributes to other environmental aspects such as recycling and energy consumption. Choosing the right material for ecological reasons demands a careful balancing act specific to each design in addition to the usual difficulties associated with material selection. It requires attention to the complete lifecycle of a product to ensure that the materials are utilised efficiently. What's more, it is not safe to presume, without knowledge, anything about a material's

suitability. For instance, plastic shopping bags, often assumed environmentally poor, have proven to be a more eco-friendly option overall, than paper ones.

Use of less material may seem an obvious golden rule, but even this is complicated by the need to consider other elements such as safety and performance. For instance, where a product is being designed for longer life, it would be more beneficial to use a larger quantity of material to improve its durability. Likewise, if a product is designed to be recycled, too little material may prevent it being practical. However, where suitable, the reduction of material use will have an impact on resources, waste and transport, both from an ecological perspective, as well as a financial one, and is thus a positive action.

One thing made evident from the difficulty of environmentally minded material selection is the lack of available information for designers. Hopefully this will improve in the near future. A regularly updated database of materials, similar to building material assessments, would go a long way in assisting the designer in this difficult task. Otherwise, designers can only be expected to learn as they go. Mistakes must be turned into wisdom, competitor achievements studied, and existing products analysed.

Energy Reduction

As energy use is the root cause of environmental treats such as global warming and pollution, designing products or equipment which are more energy efficient, or which can use alternative energy sources, should be the first priority for today's designers (Burall, a.1991, p. 36).

Reducing energy consumption is another area where improved design can make an impact. Sometimes extremely simple design changes are all that are needed to influence the energy consumption of a product. In Germany, designers at A.E.G. developed an oven that uses a removable divider so that only the part of the oven required needs to heat up (McKenzie, 1997, p. 78). Another example is the frost-free feature of many new freezers, which, as well as being a lot more convenient to the user, avoid excessive energy waste when there is built up ice in the compartment.

The capacity for improvement in energy consumption in most devices is large. Typical domestic fridges, for example, consume up to 2KWh/l annually, while improved appliances use as little as 0. 2KWh/l (Burall, 1990, p. 34). Making the product intelligent by the use of monitoring and control systems is another way to reduce the energy consumption.

In the U.S.A. and Europe, legislation requires that products be labelled with their energy consumption. This is making consumers more aware of the product's energy efficiency, and causes constructive competition in the market, which results in the design of more efficient products.

When thinking about a design's energy consumption, apart from the usage, a product's manufacturing and processing stages should also be regarded. Many materials such as aluminium are energy intensive in production, while processes for others, like plastics, are low in energy use.

Transport is another element to consider, not only with respect to energy, but also with regard to pollution levels. Reducing the weight and size of a product for transport can have a positive effect on energy consumption. Allowing more compact packing of products, for example the flat packing of furniture, can result in less energy consumed on transport for delivery. The possibility of end user assembly could aid this factor.

In all cases, reduced energy use in a product's production stage will also translate into a reduction in expenses, and the benefits of this are likely to increase in the future with the threat of increased energy costs. On the other hand, concern for energy conservation may result in completely new or altered concepts, as occurred with energy efficient light bulbs.

(Fig. 14) 'Energy efficient' light bulb

Designers could also consider the option of alternative power. Calculators are excellent examples of low power items for which light is

an ideal power source. Another prime example of an alternative power source is the Baygen *Freeplay* radio, which uses a hand wound spring, similar to clockwork, for its power.

(Fig. 15) Baygen *Freeplay* clockwork radio

If the environmental situation is to improve, attention must be given to the end of the product's life. By one cause or another, all products must die, so to speak, and consideration for their afterlife cannot be ignored. Where durability or recycling are not options, the designer can still design for minimum effect and sensible disposal.

Biodegradable Products

> ...the things we make must not only rise from the ground but return to it...without causing harm to any living system. This is ecology[2]. This is good design (http://minerva.acc.virginia.edu/~arch/pub/sermon.html).

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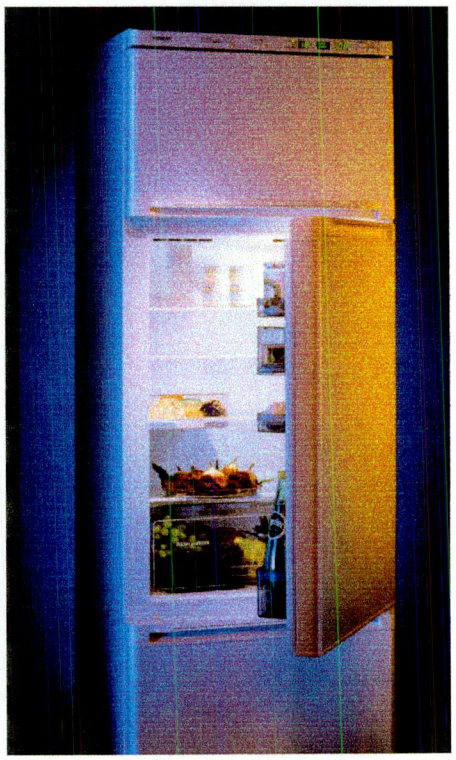
[2] Curiously, the word 'ecology' comes from the Greek roots 'oikos' and 'logos', 'household' and 'logical discourse' (http://minerva.acc.virginia.edu/~arch/pub/sermon.html).

The Complete Picture

In order to be really eco-efficient, it is necessary to consider the whole system and not only about the restructuring of a product. Take for example the refrigerator. Models that operate on hydrocarbon refrigerants, which are friendlier to the environment, were developed several years ago, Siemen's Greenfreeze, for example. Replacing existing fridges, however, is likely to be more harmful, than beneficial, because most of the damage to the environment is caused at the production and disposal stages of the product's life rather than from its use.



(Fig. 18) Siemens *Greenfreeze refrigerator*

If a proposal is to be developed for a more environmental design approach, it is clear that solutions identified cannot be abstracted from the complete context in which they must exist. It is doubtful that this will result from simply redesigning a product by applying the guidelines contained in books, such as Dorothy Mackenzie's *Green Design* or Paul Burall's book of the same name. This is possibly the reason why Green Design is met with much scepticism. This is not to suggest that an ecological approach is not viable, but to achieve it sensibly, it is

necessary to reconsider the complete approach towards the design problem, and develop a strategy appropriate to the particular case.

Some large and complex issues such as, changes to the global ecosystem or resource depletion and local/regional pollution, are effected by design decisions, but there is not space to discuss them here. It can still be recognised that the manufacture, use and disposal of different products have direct influence on these issues, and as such the designers' work is crucial in minimising the environmental crisis. If sustainable design is to result, the basic function of a product along with its actual need must be questioned and alternatives considered. The influence of each stage of the design process must be evaluated and their effects minimised. It is here that designer's skills have the greatest application to develop a more environmentally optimistic future.

Chapter 5

The Future Direction of Design

> The industrial design profession has established a place for itself in a phenomenally short time. It is widely accepted as a useful service. But it is also still in the process of realising its full potential as a service to a society going through a series of tremendous transformations.
> (Nelson, 1979, p. 30)

Just as the designers of the modern movement discovered in the 1920s and 1930s, that the "romantic insights were lies" and that it was necessary to start at the beginning (Potter, 1980, p. 57) so too, are the sector of today's design profession who care to broaden their focus beyond the drawing board and meeting room table. The industrial design profession currently appears to be treading water as it searches for a new direction. Absent also, is a unifying ideology for it to follow. Where then, is an individual designer to find identity and purpose? A new design direction and ideology are urgently needed. But unless the deeper dilemmas that exist in design are well understood, theory will simply repeat old doctrines or propound new dogmas, and this will contribute little to the advance of design or its practice.

A New Direction for Design

There comes a time in the development of a discipline, when there is a desire for it to take a look at the surrounding world, and serve society with its ideas, intuitions and possibly its beliefs and hopes (Gasparski, 1984, p. 160). The core of the industrial design discipline is, (or at least

should be) associated with the surrounding world and culture, and so, there have always been those who devoted themselves to serving society. Although it appears that the relatively young discipline of design has not yet reached the maturity necessary for more of its contributors to do so, it is pleasant to think it may perhaps be on the verge of it. Evidence in the form of multiplying conference topics, book titles and journal articles suggest that we may be in the process of developing a new and more responsible design approach, but the true indication will come when these thoughts are associated more with the actual practice of design. Only then can a new design direction be considered to exist.

Papanek wrote, "new directions in design always arise out of real changes in society, cultures and concepts" (Papanek, 1994, p. 30). Perhaps we are seeing those necessary changes taking place. The dawn of the millennium brings with it environmental concern and changing demographic trends. Might we now propose a design direction which, instead of seeming to be based solely on altruism, could be based as much on good design principles as meeting the market requirements? For what seems to be the first time in design history, a unique situation is arising where all these aspects are coming together, and a synthesised approach that will solve real issues as well as meet markets may be possible.

The success of any direction for design will be related to the degree of practical opposition it faces, and if current market changes and

legislative actions are any indication, there is now an opportunity for a synthesised 'responsible' approach to succeed. Whether it can also evolve into a new universal ethic to underlie the design of objects will remain to be seen. What is evident, however, is that the growing complexity of the questions which design is summoned to answer can no longer be matched with a lack of a unifying ideology or direction.

Industry Acceptance

If a proposal is to be developed for a more responsible design approach, it is clear that solutions identified cannot be abstracted from their inevitable links with business and economics. The production of nylon stockings, for example, is only feasible when applied to large numbers. The strong and durable nature of nylon, however, results in a long life that would reduce demand and therefore slow production, or result in market saturation. Technology was used to solve this economic problem by making the stockings more fragile and prone to snagging, and so ensure recurring demand (Mangiarotti, 1997, p. 74). This is by no means an environmentally sound solution because it encourages obsolescence, but it is clear that for economic reasons, the obvious ecological alternative would make little sense.

If it is to find market and industry acceptance, Responsible Design will still have to be competitive in terms of performance, quality, economic value and aesthetic appeal. As the case shows, not only will a design

have to offer (say) an ecologically sound option, but it will also have to provide an equivalent, or improved, economic proposal to the existing situation.

Legislation

If social responsibilities are not met by designers forced legislation often results. An example of this is the occurrence of Regulation 31: (Display Screen Equipment) of the Safety, Health and Welfare at Work Regulations 1993, which resulted from poor design of display screens. Legislation or standards often cater for specific dimensions of concern in design, but at a certain point these rules become a substitute for wisdom. Adhering to the letter of the law can often restrict design possibility. Responsible Design should, however, be capable of evading these restrictions by avoiding the aspects that legislation demands.

We should be aiming for prevention and not reaction when it comes to issues of legal restrictions on design. Responsible Design by meeting social responsibilities may prevent the need for some further legislation.

Technology

Technology has been a powerful force of change throughout history, and its influence has increased greatly in recent years with its apparent acceleration. Advances in telecommunications have reduced

the size of the world; reality is becoming clouded with the virtual; and the elements of life itself are being altered by genetic science. Technology offers huge opportunity, but the real problem will always lie in how it is directed and applied. Design provides the possibility to harness technology's potential, and apply it appropriately. The increasing resource technologies provide should be considered a tool for the designer, which they can avail of, as well as influence. Technology is not the villain it is often thought to be; it is instead, what we make it, and designers should work towards using it to improve society and benefit humankind.

A Complete Approach

To achieve sensible solutions it is necessary to reconsider the complete approach towards the design problem, and develop a strategy appropriate to the satisfaction of each requirement in a particular case. It is here that designers in the future are likely to find the greatest application for their skills and creativity. Whatever other definitions may come to mind, designers should essentially be synthesists and it is this role that can best determine a future direction for design.

Conclusion

> Every time we design a product, we are making a statement about the direction the world will move in.
>
> (Marzano, 1994, p. 15)

Instead of reflecting on what design is, we should deliberate the more constructive question of how it can be used. Design can provide a creative means of solving problems. What sort of problems it identifies, along with how they are evaluated and resolved, are its pivotal elements, and are critical to the resulting solution. It is these aspects of design, which are fundamental to a Responsible Design approach.

Designers, instead of being overly involved with creating wants or satisfying fatuous desires, should concern themselves more with the greater needs of society and its members. This will involve satisfying people's true needs, facilitating the requirements of all people, contributing to their improved quality of life, and enabling an appreciable future for society as a whole.

The humanization of design centres on knowledge of the physical and psychological capabilities, limitations and requirements of its possible users, and applying this knowledge to the activity of design. If design is to meet the real requirements of society, it must properly regard the end users, and this regard must incorporate all of society's potential users, including the older generation and those with impairments. It can no longer be acceptable for design to discriminate against these groups

or overlook their requirements. Current demographic changes not only highlight this fact, but they also mean designers will be expected to deal with the broader range of requirements from this changing population.

The fundamental requirement of all members of society is a desire to improve their quality of life. Though this improvement may take many forms, it is up to design to meet this need and contribute to people's well being. Within the designer's control are both functional and experiential factors, and they must concern themselves with increasing the usability and pleasure, for the user, of the products and services they design.

Increased environmental awareness is resulting in greater industry and market pressure on design to be more ecologically aware. Design is the principal determinant of most products and services and hence has the greatest influence on the extent of their environmental effect. Limiting a designed object's toll on the environment is dependent on considering all the stages of a products manufacture, and use, and it is critical if we are to combat the environmental situation. In addition, design should contribute to altering people's attitudes, and encourage the adoption of less damaging lifestyles. Designers must design for sustainability and aim to enable the protection of the resources we will, or may, require in the future.

In all of the topics design should have a proactive role and not simply respond to industry or market pressures. Design is a means of communication with the ability to influence. This power should be

respected by designers, and put to use in a constructive way to improve some of society's real issues.

> "Design certainly cannot change the world, nor can it design lifestyles. It cannot impose ways of acting on people in keeping with its intentions. But design can give form to a changing world, and offer opportunities for new types of behaviour" (Manzini, 1994, p. 40).

For many aspects, it is possible to replace the idea of responsibility with that of sensitivity or awareness. A Responsible Design approach should not be a conscious calculated measure; rather, it should be inherent almost to invisibility in the designer's attitudes and approach to a design problem. Responsible Design is to do with more than just knowledge; it is to do with the application of this knowledge in the form of wisdom to the complete activity of design.

Responsible Design requires totality in its approach. The satisfaction gained from its solution's must not originate only from guilt reduction. A product cannot be excused from having poor aesthetic appeal, for instance, simply because it is usable by more people or meets the needs of a particular population group. Synthesis is essential to good design and in keeping with this; Responsible Design should aim for a seamless blend of solutions to those aspects requested from it.

Those principles required to meet the individual issues of Responsible Design, are not only common to one another, they are also the principles of 'good design'. To accomplish good design demands

considering the conditions of our time, and the designs which result should serve as a positive action in response to these conditions.

Design is a tool to be used for change. Responsible Design is concerned with achieving a change towards improvement. Its objectives should be neither first nor last among a designers activities, instead, they should be an ongoing part of the process of design, helping it to meet real issues, and propelling it towards its true potential as a means to improve society and enable an appreciable future.

> No one possesses all of the knowledge and wisdom required to understand and act responsibly in this world. We need diversity and alternative perspectives to keep alive the ongoing inquiry...
> (Buchanan, 1995, p. 15)

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