Making design work
Sustainability, Product Design and Social Equity

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This paper discusses the relationship between the product designer, sustainability and the creation of good quality work within the manufacturing sector. When the principles of sustainability are applied to the nature of employment it points to a new direction for design and product production where ethics, environmental issues and social wellbeing become far more important criteria for 'success' than is currently the norm. Awareness of the relationship between 'work' and sustainability is not generally being addressed, but needs to become a part of a comprehensive approach to sustainability in design school curricula.

Introduction

Traditionally, industrial designers have concerned themselves with improving products by reducing costs, enhancing ease-of-use, and by making products beautiful and distinctive in the market place. The motivation for such improvements has generally been a desire to make mass-produced objects better for the user, as well as improving their economic viability. When environmental issues appeared on the 'radar screens' of industrial design we started modifying our practices to address the ecological damage caused by materials and resource acquisition, manufacturing processes and product disposal. While we still have a long way to go, some progress has been made in this area over the last ten to twenty years. Analytical frameworks have been developed, such as Life Cycle Assessment (LCA), that aid in the identification of problematic environmental outcomes; take-back policies have been developed in certain areas; and many designers and manufacturing industries have developed a heightened awareness of their environmental obligations. More recently some design educators, designers and manufacturers have begun to think of their work in relation to sustainability. Sustainability includes environmental issues, but also encompasses economic and social considerations. The three important principles of

The Journal of Sustainable Product Design **1**: 41–48, 2001
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sustainability *that have to be simultaneously reconciled* are: environmental responsibility, economic security and social wellbeing (Sachs et al, 1998). Less progress has been made with sustainability, partly because its appearance as an area of study is more recent and partly due to the complexity of its nature.

The focus of this present discussion will be on the social wellbeing component of sustainability as it relates to product design. Specifically, the discussion will consider the critically important issue of the form and quality of employment that is created when a product is designed in a particular way. It is argued that the ways in which products are currently conceived and designed can actually hinder progress towards sustainability. Despite often commendable efforts to include environmental considerations in the product's production, the 'employment and nature-of-work' aspects of social wellbeing are generally not being taken into account, at least in terms of their link to sustainable principles.

It is abundantly evident that a comprehensive, integrated approach to sustainability is still a long way off. Social inequities related to the availability and quality of employment in the manufacturing sector are widespread. Furthermore, many aspects of the globalisation and automation of manufacturing, with its concomitant decrease in manufacturing jobs in the economically developed countries (Rifkin, 1995), and frequent use of exploitative labour practices in developing countries, fundamentally violate the principles of sustainability. An essential factor in the pursuit of sustainability, therefore, is a reconsideration of the value and nature of human work. In the manufacturing sector the nature of work is critically related to the ways products are designed. It is, therefore, an Industrial Design issue.

Here it is argued that industrial designers have an obligation not just to the end-users of their products but also to the people employed in the manufacture of those products; whom we might term 'the middle-users'. Perhaps a common response might be to reject this obligation on the grounds that industrial designers are concerned with the design of objects and the quality of life of the end-user, and should not be held responsible for any social issues related to the manufacturing processes. Our current education systems, and perhaps the ways we educate designers in particular, tend to foster this kind of response. The prevalence of instrumentalism and an emphasis on discrete specialisations tend to narrow our perspectives and means that we rarely look beyond our immediate mandate. We fail to see the interconnections among our many and various activities. Hence, it may not be immediately apparent how the designer of products affects the nature of manufacturing work, nor how the designer can, through the way in which the product is defined, change this work for the better. Sustainability requires that we start seeing these connections, and that we start changing our thinking, from narrow to holistic, from discrete to integrated, and from morally inert to ethically responsive.

An integrated approach

Sustainability requires a much more broadly encompassing synthesis and integration of all our activities so that our ways of living become simultaneously environmentally, socially and economically sustainable. This is a complex, multifarious integration that requires globalisation *and* localisation working together, mass production *and* local production, large scale *and* small scale, product longevity *and* product ephemerality, automation *and* skill-building, fulfilling human work for all sectors of society. The false segregations, divisions, and blinkered specialisms of twentieth century industrialisation, often coupled with the pursuit of profit at the cost of human values and common decency, have proved to be a highly destructive route, for all aspects of our society, except perhaps for those few in positions to reap the short term financial benefits. To say that this is not our business, to suggest that, as designers within this system, we have no obligation or voice to start adapting our approaches towards a new value system, is to forfeit our full humanity.

Traditional wisdoms, from all cultures, tell us that the highest pursuit of humankind is the pursuit of the Good. This has been taught, in various guises, throughout history. To turn a blind eye to this, to plead helplessness, ignorance, or impotence from within the system is to forego our duty as human beings. 'What we *ought* to do' is the innate ethical component deep within all of us. If we choose to ignore it then we give up the highest part of who we are. If we have difficulty finding areas where the industrial designer can change things then perhaps we are not looking hard enough, we are accepting and contributing to a system that is, in the longer term, inherently defective from almost every angle.

Of course, Rome was not built in a day, and the enormous manufacturing sector cannot be fundamentally changed overnight. However, as we become increasingly aware of the issues we can begin to implement changes and improvements, and make suggestions, with well reasoned arguments, that will also often make good economic sense.

The nature of work

If we only consider the utilitarian aspects of 'work' then it becomes a means to some other end, with no relevant or desirable attributes in and of itself. In the early years of the twentieth century the production-line became common, often with monotonous occupations that reduced the human being to the role of a mere cog in a large machine. In many developing countries such work continues unabated. In the economically developed countries many of these production line jobs have now been taken over by automated and robotic assembly processes – not because we came to the realisation that such jobs were destructive to the human character, but because automated processes can produce exactly the same types of product twenty four hours a day and are subject neither to labour disputes nor to wage demands. The conversion of the manufacturing industries to numerically controlled automated processes over the last twenty years has been primarily driven by economic motivators, with little regard to the people who need to make a living wage in a fulfilling way. E.F. Schumacher summed up our contemporary view of human labour when he wrote, "The basic aim of modern industrialism is not to make work satisfying but to raise productivity; its proudest achievement is labour saving, whereby labour is stamped with the mark of undesirability." (Schumacher, 1980).

Work occupies a major part of our lives and it is our duty as ethical beings to ensure that work is much more than a rather unwelcome route to the achievement of some required outcome. Work can be regarded as an opportunity for furtherment of our skills and abilities, for personal fulfilment and contribution, and social co-operation. Indeed, if we are to embrace the idea of sustainability, we have to start re-evaluating our current norms and dyed-in-the-wool business principles. Business practices that extol the virtues of downsizing, automation, and Third World labour on the grounds that these are the only ways to ensure profitability, are morally dormant, to say the least. Many companies that use the more blatantly exploitative techniques have been exposed in recent years (Marlow, 1995; Sylvester 1996; Lloyd-Roberts, 1996), however, the wholesale acceptance of globalisation, automation and job elimination, is a far more widespread, generally accepted and insidious approach to manufacturing that is, implicitly, disdainful of people, the environment and the goals of sustainability.

Instead of continuing down this environmentally, socially and, ultimately, economically destructive path, we should be exploring new initiatives that will bring together and integrate our various priorities in ways that are creative and co-operative and that seek growth in human development and social equity, as well as in economic security and environmental stewardship. It is here that the knowledge, skills and creative aptitudes of the designer can, potentially, make a significant contribution – by addressing the environmental, social and economic aspects of products *simultaneously* in the definition of a product's design. This requires the development of designs that not

only utilise materials in economically and environmentally responsible ways *but also* encourage the adoption of manufacturing processes and practices that provide safe and rewarding employment for people with a range of skills and capabilities. The inclusion of these factors into the product design mandate would start to address the social equity and social well-being components of sustainability, alongside the environmental and the economic. Implicitly, such an inclusion would have consequential and potentially positive effects upon the characteristics of products and the nature of our material culture.

Thus, in seeking a more sustainable way forward, our notions of work have to change, and not just for the poorest in society but also for middle-income working people. Michael Lerner has studied this latter group for over twenty years. He has found, contrary to much popular opinion, that most middle-income Americans are not preoccupied by materialism and self-interest. They are, according to Lerner, more concerned about the meaninglessness of their work and wasting their lives. "We found middle-income people deeply unhappy because they hunger to serve the common good and to contribute something with their talents and energies, yet find that their actual work gives them little opportunity to do so. They often turn to demands for more money as a compensation for a life that otherwise feels frustrating and empty." (Lerner, 1996)

Connecting design and work

The stories that have emerged from the production-line factory systems of the early twentieth century have now become apocryphal. They speak of monotony and mindless repetition and are summed up in Henry Ford's maxim, "The man who puts in the bolt doesn't put on the nut, and the man who puts on the nut doesn't tighten it."(Raymond, 1986) Charlie Chaplin's classic film Modern Times, in which he was literally dragged through the cogs of the giant machine, satirised this servitude to the mechanistic process. Since these earliest manifestations of mass-production other approaches have been explored such as 'Just In Time' manufacturing that attempts to reduce inventory and meet customer needs on a more manufacture-to-order basis; flexible manufacturing – incorporating automated, robotic cells; and Computer Integrated Manufacturing where materials supply, component manufacture and product assembly is, at least potentially, fully integrated and automated in terms of production. In places there are also the vestiges of craft oriented techniques, where human labour and the 'human touch' in the product are still valued – although, generally, these are small and their contribution to the economic security of a region or country is usually marginal, at least in the economically developed countries. All these approaches have different ramifications for how a product is designed and for sustainability.

Despite the introduction of many automated production processes since the 1970's, there are still many tasks in manufacturing that, so far, defy complete automation. Unfortunately, our approaches to manufacturing frequently mean that the machines and automated processes are used to complete all the principle tasks in the manufacture of a product, and the human workers are there to occasionally change a tool head or transfer a part or to do tasks that require complex manipulations that cannot easily be automated.

Consider the typical manufacture of a telephone. ABS polymer pellets arrive by truck in large cardboard containers. These are connected by vacuum hoses to the hoppers of injection moulding machines. The mould blocks open and close continually, and each time they open the moulded parts are ejected onto a chute where they slide down to a person waiting with a sharp knife. The person picks up the part, trims the sprues and any flash, and places the part on a pile. That person then waits for the mould to re-open and the process is repeated, again and again and again. In another stage of the process, mass produced electronic components are automatically sorted and fired into

a circuit board via a robotic head. When the circuit board is complete it travels through an automatic soldering station and the boards are taken through a set of pre-programmed tests using a robotic arm. Once all this is completed, low paid workers are employed to put the circuitry inside the ABS casing and to insert the screw to hold it all together.

This approach to manufacturing is not confined to the production of telephones – it has been broadly applied across many areas of product production. Shop floor workers are reduced to a minimum and those remaining are often low skilled and low paid. This is generally seen as a good thing, a move in the right direction, a way to remain competitive and profitable.

In order for this system to be maintained it requires regular design input, to keep products looking up-to-date, to adapt product designs to new technologies and to include new features. The larger corporations employ their own in-house designers and frequently invite the services of industrial design consultants. Industrial designers conduct their work within this milieu and they design products to be manufactured within this system. The products are designed in such a way so as to fit the assumptions of this production methodology. Occasionally incremental initiatives might be introduced that require a slight alteration, the introduction of a new polymer, or a new stage, but basically the product designer works *within* and *for* this system. The designer, therefore, complies with the rules and requirements of this automated mass-production infrastructure and, in doing so, contributes to its continuation, despite the fact that it is fundamentally flawed with respect to sustainability. The recyclability of the plastics being used, or the reduction and/or reuse of packaging materials (features often much publicised by manufacturers) are minor nods in the direction of green design but are relatively insignificant in terms of a substantial and serious re-orientation of our techniques and approaches towards sustainable principles.

Alternative Solutions

Alternatives to our current approaches are possible. For example, at Mondragon in the Basque country of Spain, a large number of highly profitable co-operative businesses have been developed. The Mondragon business approach has a strong ethical component at its centre. There are controls on wage differentials, so that the highest paid do not exceed the lowest paid by too great a margin. A more human, socially responsible approach to technology is also taken. The fully automated 'dream' of Computer Integrated Manufacturing is eschewed as an unsatisfactory direction. "Persons who study machining at the Eskola Politeknikoa first learn the classic manual techniques, then are introduced to the use of the numerically controlled machines that are becoming the standard. Workers are retrained, not de-skilled. The Mondragon-produced Aurki machine has been designed to enable a properly trained machinist to program and reprogram it as needed, in contrast to models where programming is done by management or engineering personnel and the machinist becomes just a material feeder – and often a scrap producer." (Morrison, 1991) Solutions such as this stem from an unwillingness to accept the *status quo* and a belief that there exists an acceptable alternative, if we but rethink the process.

Another example of this rethinking comes from William McDonough and his work with DesignTex. It addresses environmental issues both in terms of materials and manufacturing process. In the early '90s William McDonough was asked by DesignTex to contribute to its Portfolio Series. This line of textiles consists of designs by respected architects such as Robert Venturi and Denise Scott-Brown, Richard Meier and Aldo Rossi. Rather than simply applying his 'design' skills to this project McDonough, in collaboration with chemist Michael Braungart, designed not only the appearance of the cloth, but also its chemical content and process of manufacture. Besides rethinking the fibre content of the textile McDonough and Braungart tested 8,000 commercially available dyes which they then limited to

sixteen, selected because they are entirely free of carcinogens, mutagens, persistent toxins, heavy metals, endocrine disrupters and bioaccumulatives. As a result, the fabric is a completely compostable "organic nutrient," capable of safely returning to the earth at the end of its useful life. (Calmenson, 1997) When giving this new textile line an ID Magazine award (one of several it has won), juror Thomas M. Edwards said, "The fact that the entire process of textile manufacturing was completely reimagined and reworked makes these fabrics more than just the ecological design of the day, it catapults them into a new realm." (ID Magazine, 1996) While these and other such examples are highly laudable, they are still far too infrequent to affect permanent change and in the end act only to establish the issue on our 'radar screens.'

Integrating scales of production and supply chain considerations

Many authors on environmental and sustainability issues suggest that we should be paying far more attention to the notion of 'place', at all scales of intervention. For example, urban designers have been looking at the ways towns and human settlements are planned, so that people can walk to work, or use public transport, or cycle. While urban design is outside the immediate domain of our profession, this sort of integrated, localised approach can be a model for our own work. A model such as this suggests that we consider the manufacturing of products at a more local scale, utilising locally available materials together with mass-produced components where appropriate. A variety of local manufacturing endeavours for local or regional markets would create a great many benefits. Environmental gains would include reduced materials transportation, reduced packaging, easier product maintenance, reuse and recycling and so on. In contrast to the example of telephone manufacturing described earlier, local scale manufacturing could also create opportunities for work that permit, indeed encourage, creativity, engagement, fulfilment, satisfaction, enrichment and a sense of achievement. Local scale manufacturing and assembly that combines locally made parts with components that are more appropriately produced using mass-manufacturing techniques would also contribute to the economic well-being of a locality or region and thus help foster a culture of permanence. Hence, this type of approach would allow the three major aspects of sustainable development to be simultaneously addressed.

In working towards these more sustainable approaches, it becomes important to examine the issues surrounding component procurement and the supply chain of materials and parts. A move towards more local scale and locally specific design and production practices highlights a number of important areas for consideration.

Certain components, specific to a particular product design will best be made, where possible and appropriate, at the local level – either in or in close proximity to the place of assembly, and utilising local materials and local labour. This would help ensure that a locally relevant supply chain is developed which not only creates employment for local materials suppliers but also reduces transportation, packaging and infrastructure requirements. In turn, environmental stewardship is enhanced – directly, in terms of a reduction in operations that can be environmentally detrimental, and indirectly because there will be a vested interest in ensuring that the local environment, in which people live and work, is healthy, and that the supply of local materials can be sustained, for everyone's economic benefit.

Other components, such as electronic parts, electrical fittings and standard, off-the-shelf fastenings and fixtures (such as screws, nuts, bolts etc.) are best produced using mass production techniques. High capital investment to produce such components means that limiting production to the needs of local markets is impractical. Hence, these high production quantity parts will have to be delivered to the local product production facility from elsewhere. This raises significant issues for

sustainable production because these 'imported' components will be outside the immediate purview of the local product manufacturer, with respect to labour practices, and environmental consequences of the production and transportation of the components. We see that this extends further back to include the suppliers who ship the materials to these producers. It obviously becomes more difficult to ensure that sustainable practices are consistent throughout every link of the supply chain, particularly when these operations are conducted at locations remote from the local product production facility. Moreover, the availability of suitable 'standard' components also becomes an issue. Components are required that allow their incorporation into locally appropriate designs, design for disassembly and repair, and so on. This in turn has implications for labour, and the quality of work created in product reprocessing.

This suggests that the supply chain might expand out from the local facility in as incremental a way as possible. From the local to the regional to the national, and if necessary, to the international. This would facilitate understanding and monitoring of supply chain practices according to provincial and national guidelines. It also suggests that those involved at each stage of the supply chain need to be made aware of the issues through education programmes, government incentives and, perhaps most pragmatically, through buyer vigilance.

In order to pursue such a direction, the role of the designer is paramount. It becomes necessary to develop product designs that will integrate scales of production in their manufacture, that express the particular cultural values of a region, that can be made locally using, where possible, locally produced or locally available materials, and to do this in ways that create good quality employment while also being economically viable. This indeed a significant design challenge.

The *implementation* of such product designs would depend on the development of approaches to manufacturing that are aligned with this broad, integrated, sustainable course. The difficulty in moving forward is perhaps a classic 'chicken and egg' paradox. Designers may feel little incentive to design products for an alternative, more sustainable manufacturing system until that system actually exists. However, designers are those people within the manufacturing sector that have an appreciation of the numerous aspects involved in a product's development. Moreover, they are also the people who, through their abilities in creative visualisation, can offer an image or vision of an alternative, more sustainable approach. We might also pose the question, "If *not* the designer, then who?" This is not to put the onus entirely on the designer's shoulders. Ultimately it is the responsibility of all involved to steer manufacturing in a more sustainable direction. However, the creative design process coupled with the visualisation capabilities necessary to the profession are a powerful and effective skill set that the designer can offer to take the sector forward.

Conclusions

Sustainability is a highly complex undertaking with myriad interrelated, interdependent facets. Designers can play a significant role in our progress towards sustainability by using their particular knowledge and creative skills, and in doing so can make a unique contribution within the manufacturing sector. However, in order to do this, the broad mandate of sustainability must be part of the designer's knowledge base, together with the particular implications this has for design and manufacturing; this includes a consideration of the way we design products and the effects this has on the quality of manufacturing work. Currently, these areas of knowledge are not a significant component of most designers' education and training. While environmental issues have begun to enter design studies, sustainability and its relationship to pragmatic product design is generally not being addressed. Design schools, therefore, have a responsibility to develop their curricula to include sustainability in both theoretical course work and in design

studio classes, where the theoretical underpinnings can be translated into physical form. There is also a need for professional development for practising designers. Thus, perhaps the most important factor in assisting the design and production sectors towards sustainability will be the development of appropriate educational resources. It is through our education institutions that awareness of the issues can be raised and the implementation of solutions can be explored.

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