Adding Value Through Digital Craft

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Abstract:

This thesis is an attempt to embody sustainability by discovering value that transcends cost or function. Many objects are considered waste when they still function, but no longer delight the user. Using digital modeling tools and computer numerical controlled machines, designers can digitally craft products unique to the individual. Utilizing these aspects to create pleasure, designers can motivate consumers to be more thoughtful in their consumption, extend the desirable life of a product, and change the current societal norm of disposability.
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Introduction

The issue of sustainability within Industrial Design is complicated. It is impossible to take every factor of sustainability into account because mass production is inherent in Industrial Design. Mass production generally requires a lot of transportation: material comes from one place, is shipped to a manufacturing facility, then shipped to stores, then shipped to the consumer. Industrial Design is also directly related to the creation of trash – waste from the manufacturing process, packaging that is thrown away, and inevitably the product itself when it ceases to function or delight. While all products have a lifecycle, and many designers are planning for the product’s end, it is the consumer that will decide what ultimately becomes of the object.

Designers can motivate the consumer to keep the product, repair it if it gets broken, and hopefully pass it down to the next generation by studying the emotional implications of products and discovering why still functional objects are thrown out. By considering how the product will age and using digital craft and the ‘DIY’ movement, designers can create a product that will be unique to the user, thus motivating them to keep the object and perhaps giving them the ability to repair it.
Sustainability?

Informing society of green living is a double edged sword. On one hand, knowledge of sustainability allows our society to grow, learn about our current situation and perhaps desire to make an impact; on the other hand, the resources that are poured into the effort of informing the populace and motivating change are basically unsustainable. The high profile of green living has recently produced magazines, t-shirts, bags, cars, and more that are dedicated to sustainability. While this trend increases the profile of the issue, it also increases waste since these new products are replacing old, possibly still functioning, products. Green living has become a form of “conspicuous consumption” a term coined by the sociologist Thorstein Veblen describing the fact that we purchase items in an attempt to advertise who we are. This is also referred to as Signaling Theory (Bloom, 43), and applies to much more than just advertising the desire to be sustainable.

Consumers are now more aware then ever of the issues surrounding sustainability and have been “buycotting” to show their increasing support for the green movement. “Buycotts are the sister practices of boycotts, referring to the active consumer choices of products and services which consumers perceive as being in line with their values.” (Bostrom and Klintmann, 39)
Now that the consumer is more conscious of what their purchases mean on a larger scale, some of the products that are being offered to them are masquerading as ‘green’, with little to no attributes of sustainability. This process is known as greenwashing and has turned the educated consumer away from the traditional market. This is not necessarily the fault of designers, marketers, or companies; the issue of sustainability in product design has many facets and it would be nearly impossible to take each into consideration, especially when a product is to be mass produced. When a product is mass produced there is little possibility of using locally sourced materials, or reducing the distance a product must travel from the production site to the consumer. Yet the very nature of product design is mass production.

“The idea of a less possession minded society grates somewhat with the social ideal of ‘affordable and therefore within everyone’s reach’ that has always been a key factor in the design discourse. Designers are expected to fashion products that can be sold in large numbers. If the products they present are too expensive and too exclusive for mass sales, these are often labeled as elitist. The ultimate design goal, evidently, is still a wide circulation.” (Ramakers, 17)

Mass production has been the answer for affordability since the dawn of the industrial age. With mass production and a wide circulation come the intricacy and multi faceted aspects of sustainability within industrial design. Mass production and the resulting wide circulation make it difficult to have locally sourced materials, or take shipping and packaging out of the process. All this complexity of sustainability can have a negative effect. Guy Hawkins writes about how the current confusion can be off putting:
“Environmentalism has always been concerned with commodities, but usually in ways that involve moralistic critiques of over-consumption and wasteful disposability. The problem with this approach is that it easily breeds resentment, guilt or a paralyzing sense of personal anxiety about one’s role in the destruction of nature. Or environmentalism can take a political position, letting the consumer off the hook but railing against the capitalist excess of corporations that produce commodities nobody needs. I don’t disagree with these critiques, but I worry about their effects, particularly the way they close off other sorts of ethical responses. Moralism and blame have never been good motivators for political change.” (Hawkins, 57)

There is hardly a debate on the necessity of considering sustainability within a design. There are, however, many different reasons on why it is necessary: limited resource flows, pollution, and waste. Waste, especially of still usable items, is a large part of the sustainability equation, “Only 1 percent of material flows in the U.S. economy ends up in, and is still being used within products six months after their sale.” (Thackara, 12) That means 99 percent of what is purchased today will end up in the recycling bin or the dump. While recycling is a better option than a landfill, it still takes energy - and will therefore cause some pollution – to complete the process. Not only is recycling still affecting resource use, it is also affecting the way consumers view their actions.
“Amidst the frantic scramble to comply with growing legislative demands, the root causes of the ecological crisis that we face are frequently overlooked. Meanwhile, consumers continue wastefully on, but do so, now, with recycled materials instead of virgin ones. Although advantageous in a number of scenarios, recycling alone is not a one-stop solution to sustainable production and consumption; it represents only a small part of a far wider picture. Many researchers are beginning to suspect that recycling actually provides an ethical ‘get out of jail free card’, which liberates consumer conscience and, in doing so, generates even more waste.” (Chapman, 10)

What is needed is a simplification in the green movement, perhaps even removing sustainability from the marketing lexicon of our products so as to remove the stigma attached and motivate consumers in a more pleasurable way.
Value

The photographer Bill Keaggy has created a collection of photographs he calls 50 Sad Chairs to call attention to the fact that many still functioning items are thrown out everyday. Some are not fully functioning, but are not beyond repair. Guy Hawkins writes of his interpretation of this collection:

“The garbage of modern life has no meaning except as objects wrecking nature. Yet, here, with these images, a different feeling takes over, a melancholy that forces us to notice abandoned things and feel for their plight. Suddenly, it is not nature we feel concerned about but these forlorn chairs. Most of them are dead or dying: they have been captured at the point when they have run out of value, and not just as a result of material decay- many are still functional – but because, for whatever reason, they have been rejected.” (Hawkins, 55)
The fate of all products lie in the hands of the user: will they throw it away, recycle it, resell it, hand it down, or keep it? Many products are thrown out when they can easily be repaired; some are thrown out even when they still work. These products still have a functional value, yet they are no longer emotionally valuable to the owner.

Designers can create pleasure in their products to motivate the user to keep the object. Designs that delight are often kept long after their use has faded. Some objects are kept even when they have no readily perceived function other than to be enjoyed, such as art work or souvenirs, these pieces exist for pleasure. So when a designer successfully marries function with pleasure, the result can be a product that the consumer enjoys to the extent that when it breaks, he will make the effort to repair the object rather than throw it away. This emotional value is often related to the object’s relationship with its owner, the past they have shared together. An Eiffel Tower keychain can mean nothing to a person who has never ventured to Paris, but can be extremely valuable to a person who purchased it from a street vendor after ascending the tower on their honeymoon. The emotional value of an object often lies in its ability to tell a story. The product must be able to describe some aspect of the consumer in order to be valuable. Along with mass production came the commoditization of goods. Shoes are no longer to simply protect our feet, they are a way for us to show who we think we are. Skate shoes, work boots, high heels, waking sandals all describe who we are or who we want to be. Now it can cost more to get an old pair of shoes fixed than to simply buy a new pair of shoes; shoes that reflect the constantly evolving consumer.
“The worldview fostered by the machine values convenience, disposability, and planned obsolescence, values that could hardly exist without the machine. In a deeper sense, to the extent machine production has flooded the earth with stuff, it has transformed our relationship to things by altering those traditional concepts of work, production, value, and proportion that formerly derived from the human hand and body.” (Risatti, 198)

The value of the object lies in how it makes us feel, not the actual monetary worth of the product - although raising the cost often raises the emotional value if only for a short while. “Prestige, perceived rarity, and exclusiveness work at the reflective level. Raise the price of scotch, and increase the sales. Make it difficult to get reservations to a restaurant or entrance to a club, and increase their desirability.” (Norman, 88) Because we live in a society based on material culture, the purchase of a monetarily valuable object is a symbol:

“Earlier forms of material culture embodied an animalistic appreciation of the physical world not too different from the way we perceive it today. Animism of this nature was prevalent among primitive peoples, with the ‘belief that inanimate objects and the phenomena of nature are endowed with personal life or a living soul’. Examples of this might include feathers believed to be sacred, pebbles that could heal the sick or a tiger bone possessing the strength and vigor of the deceased animal. All of these items could be owned and thus afford the owner with their
animal. All of these items could be owned and thus afford the owner with their signified properties, in a similar way that a Prada bag might afford elegant sophistication today.” (Chapman, 58)

The acquisition of an expensive item is a signifier that the owner is worthy of such an item. These deep seated, cultural drivers for consumption are never ending, leading to a constant desire for newer, shinier objects. This leads consumers to always be on the hunt for the next object that will give them the attributes that they desire to embody.

Electronic goods are subject to an even faster synthetic lifecycle. “In theory, electronic products have technical service lives on the magnitude of thirty years, but thanks to ever-shorter innovation cycles, many devices are disposed of after a few years or months.” (Thackara, 11) Consumers lack any connection to their electronic products because the value of the object lies only in the capability of the technology. The technology still functions, but a superior model is often rolled out almost instantaneously after the previous model.

“Placing technological currency as the sole product value-indicator ensures loss of meaning the moment a newer model hits the shelves. In a marketplace of relentless product obsolescence, the notion of consumer satisfaction will continue to remain a
tantalizing utopia until product values diversify to incorporate factors beyond technical modernity - enabling consumers to transcend the temporal urgency of techno-centric design and engage with their possessions over greater periods of time, and on a diversity of emotional and experiential levels.” (Chapman, 16-17)

If a person is wising to signify that they are early adopters, meaning that they take pride in the fact that they are current on the latest technology, they must constantly be purchasing the newest product available, thus finding some fate for the product they are replacing. If a product no longer reflects who we think we are or who we want to be it is no longer valuable and therefore vulnerable to becoming waste. But if a product is unique to the owner, or evolves with him, abstractly recording the history of its relationship with the user, it can create a lasting bond.
Digital Craft

Craft is a broad term usually involving the skill required to participate in a specific trade. Craft used to be the only way a design could be realized, and it usually involved the end user. “A hundred years ago, if a new chair, carriage, kettle, or a pair of shoes was needed, the consumer went to the craftsman, stated his wants, and the article was made for him. Today the myriad objects of daily use are mass-produced to a utilitarian and aesthetic standard often completely unrelated to the consumer’s need.” (Papanek, 220) Products that do not fully meet the consumer’s needs are often unwanted the moment another product that more closely fits the consumer’s needs is produced. Although it seems as if craft would be welcome in the design community, the term craft can take on a negative tone, conjuring images of novices painting t-shirts, scrapbooking, or arranging fake flowers. Since the industrial revolution and the resulting modernist movement, craft was no longer seen as necessary and products became one of thousands in a production line. Not only was craft seen as unnecessary, it was beginning to be seen as outdated and of a lower class:
“Another legacy of modernism is a distrust of skill and fine craftsmanship. The history of modern art records a gradual abandonment of the traditional crafts of painting and carving, partly as a symbolic rejection of academic taste and, ultimately, of bourgeois culture.” (Metcalf 2007, 14)

Since craft was vilified within the design community, products are made for the masses and often do not fit the unique needs of an individual. “The attributes that make something personal are precisely the sorts of things that cannot be designed ahead of time, especially in mass production.” (Norman, 218) These objects from the production line ultimately end up in the dump; however, craft objects fall into a different category of product design, “The destination of the work of art is the air conditioned eternity of the museum; the destiny of the industrial object is the trash barrel. The handcrafted object ordinarily escapes both of these.” (Paz, 21) Handcrafted objects, and now digitally crafted objects can be manufactured on a smaller scale and can be tailored specifically for the user. These aspects give the perception of rarity and gives emotional value to the object.

Craft objects are a key component in product sustainability. David Pye describes workmanship in two ways: a workmanship of risk and a workmanship of certainty. Workmanship of risk encompasses hand crafts and describes objects in which the quality of the outcome is constantly at risk. While the workmanship of risk can yield unique objects, it is also expensive. The workmanship of certainty is characterized by speed and accuracy and leads to a slew of exact copies that have no personal features. Digital craft however, is a combination of the workmanship of risk and the
Fig. 3: Tea and Coffee Towers - Greg Lynn - Alessi
“The attributes that make something personal are precisely the sorts of things that cannot be designed ahead of time; especially in mass production.”

- Donald Norman
workmanship of risk and the workmanship of certainty. By using computer modeling programs as well as computer numerical controlled (CNC) machines, designers can create individual products with speed and accuracy. Greg Lynn states that, “[The] digital medium has organic qualities” because, like nature, the digital medium is based on calculus, has an infinitesimal dimensional series, works on a language of curves, has continuous sequences, and understands the intricacies of scale. Because the digital medium has organic qualities, digital craft has similar properties to hand craft and can thus afford digitally crafted products the same values.

The industrial revolution greatly changed the products we use today and produced the field of industrial design, now the design field is entering a new revolution. The digital revolution is now in full swing and has allowed designers to re-discover craft. Complex forms are possible once again now that we have machines capable of manufacturing unique crafted items.

The democratization of the digital is another factor to consider when discussing digital craft and product design. There is a growing do it yourself (DIY) movement in product design which has emerged from the development of digital manufacturing tools. These tools are becoming increasingly available to the average consumer, thus creating value in the objects that they will conceive of:

“Something we have created ourselves, or that a loved one has created, has a different kind of value for us. Such an object will be valued despite any lack of skill evident in its creation, and whether or
not it actually functions well or as intended. It is valued over and above function and appearance. Its value for us is inherent to the thing itself as an expression of one’s creativity, or because of the personal association that it represents, rather than solely on its utilitarian merits or aesthetic attributes.” (Walker, 57)

Objects that are created by our loved ones are also valued because they are scarce; our society has not relied on personally made objects since the Industrial Revolution made products so affordable. These objects are pieces of priceless personal art that, if they cease to function, would most likely be repaired instead of thrown away. This quality of value beyond use does not only apply to objects made by loved ones, it also applies to designer or luxury items that have been well crafted. These pieces can become antiques that families would use and pass down through the generations.

“Having previously been associated with excess rather than discreet consumption, the concept of responsible and conscientious luxury consumption is somewhat paradoxical in itself, and could be superficial conscience salving rather than a change in attitude from the super rich minority – a “green is the new gold” attitude. There is however, another perspective, in that buying long lasting craftsmanship, highest quality and unique items means they will be treasured for a long time, becoming heirlooms of the future, and contributing to a lower rate of consumption.” (Black, 79)
Sewing machines and power tools have long since allowed a consumer to make their own clothing or furniture, yet most consumers still desire a designer piece. Most of society still desires brand name items as a signifier of their wealth or worthiness. Household sewing machines are mostly used for alterations or repairs to a purchased item and power tools are used in the installation or assembly of a purchased item. The term ‘home-sewn’ is often used in a derisive manner by judges of fashion focused television shows. “The idea is that displays of personal quality are only taken seriously if they involve some cost, some level of difficulty or sacrifice. If anyone can easily do the display, then it is worthless, because it is trivially easy to fake.” (Bloom, 83)

Perhaps a more realistic view of the DIY movement is that it will allow designers to work closely with craftsmen instead of large manufacturers, craftsmen who are more closely connected to the communities they serve. This combination could allow consumers to have unique designer objects that more closely fit their needs. Because of the cheap, readily available nature of mass produced items, the idea of craft is changing to favor the DIY and craft movement, “Craft skills have become a luxury item. These days everything has to be done quickly and cheaply.” (Ramakers, 164) Because craft is so rare, it has become the more expensive, luxurious display.
Digital craft is giving value in the sense that it is individually created and can be unique much like the user. It offers the possibility to allow the user to participate on some level with the making or repair of the product. The DIY movement can be a way for users to customize a designer object to their specific needs, or print out a replacement part that would otherwise have rendered the product un-functional. The user’s ability to affect the product outcome can have implications on the emotional value of the object because they have a history with the object even before it has been manufactured.
Fig. 4: Godogan table - Neils van Eijk and Miriam van der Lubbe
Digitally Crafted Container

In recent years, there have been a growing number of computer numerical controlled machines that can craft digitally created objects. The choice to use a four axis mill was derived from the desire to experiment with different types of materials as well as the increased amount of control the craftsman can exert upon the final object. Alternative rapid prototyping machines available included the 3d printer which only manufactures in plastic, and the laser cutter which works in 2 dimensions, meaning the object would still require a great deal of finishing. This decision then informed the dimensions of the containers as well as the software that must be used in conjunction with the mill.
Initial Concept

The driving concept was to create a set of food containers that would be individual to the user’s dining habits and nest together to incorporate the entire meal. There would be an enclosing piece that would keep the containers together for ease of transportation. The lunch containers would be individually, and uniquely crafted so that the user may have a personally designed object that they will value at a reflective level.
Form Studies

The form studies were generated initially by hand sketching then moving into computer modeling. This method was used to employ a greater degree of precision and variation found in the digital modeling and to work within a construct which simulates the three dimensional world that the object will inhabit.

These images are a representation of the study of form, scale, volume, and variation.
The development of digital modeling tools offers a new level of variation to the fabrication process. The most notable being Grasshopper, a graphical algorithm editor for Rhino. Grasshopper allows the designer to set and control the parameters for variation instantaneously. The image below shows the Grasshopper script written in order to vary the forms. The sliders on the left allow the user to vary the curve degree and number of control points for the curved area of the object.
The figures below are some examples of the variation that can be achieved using the Grasshopper script on the previous page.
Craft Variations: CNC Mill Software

After developing the digital model, it is exported to an STL file format and opened with the CNC mill software. The Roland MDX-540 mill uses the Roland SRP Player as its software. This software prompts the craftsperson to input information depending on the desired outcome. This information includes the size of the mill bit, depth of cutting, roughing and finishing parameters which can effect the overall outcome of the final piece and allows for diversity within similar objects.
Study Models

This model shown is the first iteration in the series of study models. It represents a study on form, variation, and using the finishing of the mill as a textural quality.

The model on the left received a finishing pass with the mill that gives it the smooth appearance. The model on the right was given a roughing pass only which creates the uneven texture. Both objects lie on opposite ends of the series of variation set up for the form. Given that the variation affects the entire form created an amorphous shape that needed to be re investigated.

These models inform the series of study models that follow.
This second iteration is a study of form, connections and finishing quality.

This model was the first to designate a zone of variation, an area where the variation could take place and still allow the object to relate to the others within the series. Identifying the zone of variation is key in the relationship of the designer to the user.

Allowing the user to affect the variation within the zone can give the user some control while still having a designer piece. The ability to foster a relationship with the object even before it has been manufactured creates an emotional value needed to encourage the user to keep the object.
Study Models

The third iteration was the first attempted at full scale.

The form of this model was elongated in order to maintain the volume, yet fit within the dimensional parameters of the four axis mill. This resulted in the decision that the containers could also fit within a user’s backpack or briefcase.

It was also done in a dense foam material to explore what differences the material would give to the process. These containers were roughed out only, no finishing pass was done, and the texture was a result of the mill understanding that the dense material would need more shallow roughing passes than the softer foam material in the previous models.
This last study model consists of individual containers had been re-sized in order to be carved out of a 2x4 piece of lumber.

The widely available nature of dimensional lumber was the driving factor behind the decision to have the containers fit within a 2x4.

This proves that the value of the object does not lie within the material, the value is within the process and the craft that creates the final object. Using relatively cheap, readily available material also brings the cost of the product down, meaning that consumers can come closer to affording a uniquely crafted item.
Final Model

The final model was derived from the successful completion of the fourth study model. It is milled from dimensional lumber and has an aluminum sleeve to hold the pieces together.
Conclusion

The digital medium is effecting the field of design, not just in the aesthetic sense of allowing designers to readily see their ideas, but in the larger social context. Utilizing computer numerically controlled machines to manufacture goods allows for small scale manufacturing tailored to the user’s needs.

The current trend in digital tools and software opens up the possibility for the user to have a hand in creating the object. Designers can set up parameters in their designs and create a zone for the user to influence, this gives the user the ability to participate on some level with the object and creates an emotional attachment to the object while still giving the user a designer product.

The process of digitally manufactured goods allow for control in the modeling process as well as in the crafting process. The decisions that are needed to operate CNC machines are similar to the decisions needed with handcrafted objects. Crafted objects are rare and unique, be it by hand or machine, which creates an exclusivity that makes it far less likely to be tossed into the landfill.
Individualized products for the user have a value greater than the functionality of the object. The idea that the object is theirs alone and no other identical object exists gives it an emotional value that makes it hard for the owner to part with the object. Knowing that products are often a symbol of a person, and are easily tossed out by the user because the object does not reflect who they think they are, unique products are a symbol of people, all of whom are unique.

Imbuing products with individuality means that there will be less waste. This quality creates products that are more pleasurable and unique to the user, and can be used to change the notion of sustainability in product design.
Image Credits
All images are by the author except those noted below

Fig. 1: Keaggy, Bill. *50 Sad Chairs*, 2008. Photograph. Pittsfield, MA.

Fig. 2: Bethan Laura Wood, Stain Cup and Saucer, 2007. [http://www.woodlondon.co.uk/PAGES/COLLECTIONS/TABLE/STAIN1.html](http://www.woodlondon.co.uk/PAGES/COLLECTIONS/TABLE/STAIN1.html) (accessed October 6, 2010)


Works Cited


