Applying the Metacycle Principles as a Strategy for Sustainable Design Education -A Tribute to Charles and Ray Eames

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Abstract: Inspired by *Metacycle* [1], a design research initiative that aims to prolong the lifespan of everyday objects (metacycle.ca), this paper describes a project that was assigned to senior level design students with the objectives of transmitting advanced conceptual and creative skills while bringing students to integrate fundamental sustainable design principles. The challenge presented to the group of students was to design and fabricate a base for salvaged chair parts designed by Charles and Ray Eames in the 1950's. This project stimulated students to deeply engage in the development of high quality designs while encouraging them to understand the importance of preserving the environment and also the cultural heritage related to objects that are much too often discarded after the end of their useful life.

Key words: Metacycle, Sustainable Design, Material Culture, Design, History, Charles and Ray Eames, Design Education.

1. Introduction

According to the International Council of Societies of Industrial Design (Icsid.org), design is a creative activity whose aim is to establish the multi-faceted qualities of objects, processes, services and their systems in whole life cycles. Therefore, design is the central factor of innovative humanization of technologies and the crucial factor of cultural and economic exchange. In general, designers concentrate their expertise on the creation of products related to a broad range of domains, including furniture, transport, electrical and electronic appliances, lighting, medical devices, sports equipment, etc. Design education is therefore concerned with transmitting both the theoretical and practical knowledge involved in this complex activity.

But what about the sustainability dimension? With the current environmental crisis, the field of design is more than ever challenged by finding solutions and developing products that should have less negative impacts on the ecosystem, which means using less resources, less energy and finding ways to re-use and recycle the materials and the various parts of all the objects we use after their end of life. For many design schools, the environmental issue has become a central preoccupation, as students need to understand that it will be their responsibility to integrate the fundamental principles of sustainability through an ecological perspective, but also from a socio-cultural and economical standpoint.

Since many years, an interuniversity and Montreal-based research group has focused its interests towards issues related to sustainable development and attempts to develop strategies aiming at inducing a fundamental paradigm shift in our society of consumption. Essentially, this means putting less emphasis on the production of new things and paying more attention to notions of maintenance, re-use, repair and durability. Design activities

usually concentrate on developing innovative products, but more and more, the sustainable era calls for the re-use of existing materials and recycling. How can these incongruous objectives lead to novelty and innovation? How can we bring students to realize the creative potential of re-using and refurbishing old objects that otherwise would end up in garbage dumps or landfills? This paper describes how a research project entitled Metacycle has inspired a pedagogical approach, which had the specific objectives of developing advanced design skills, while integrating notions of ecology, and both socio-cultural and economical sustainability.

2. Background Context

Since the late sixties, ecologists have been raising their voices in opposition to the western world's profligate lifestyle. A few designers were among adamant agitators for a reassessment of our wasteful habits and the values that support them. At all scales, the message was the same: progress as measured by unending growth is an untenable paradigm, leading to both depletion of non-renewable resources and the poisoning of the planet through the increased production of toxic pollution. Jane Jacobs argued that architects were destroying the ecology of the built environment through the promotion of urban sprawl [2]. Victor Papanek criticized designers for participating in the suicidal race towards ecological disaster through their contribution to the relentless rise of consumerism [3]. At an even earlier date, Buckminster Fuller demonstrated how wasteful building methods were standing in the way of providing adequate shelter for all [4].

Half a century later, in line with notions of sustainable development established at the Rio World Summit in 1992, a group of ethically responsible designers are proposing changes in our ways of doing things in order to reduce the negative effects of our society's excessive consumption (McDonough and Braungart, 2002; Lewis and Gertsakis, 2001; Charter and Tischner, 2001; Design for Environmental Sustainability, 2008, etc.). It is along this axis that a Montreal-based university research group has initiated the Metacycle project, with the objectives of linking the latest digital technologies to prolong the life span of manufactured products and thus reduce the deleterious effects of over consumption.

The premise at the root of this research concerns the organic nature of manufactured objects; like living things, objects could potentially change over time. Jonathan Chapman considers that a product's life span is determined in large part by the attachment linking it to its user and that this could be enhanced by the product's ability to evolve and change over time [5]. While this ability is often seen in the area of software design [6] where updates, patches and versioning enable programs to evolve not only to correct errors but also to meet new needs, some researchers have made attempts at transferring this aptitude to physical objects [7, 8].

As design researchers and also educators concerned by environmental issues, the important question to address is "How can we raise the students' awareness regarding sustainable design practices? In order to reach this objective, a group of design students were introduced to the Metacycle project, a concept aimed at establishing a network of designers applying their creativity to proposing how existing objects could be enhanced and modified in order to take on a second life (Figure 1). Previous work called PRéco [9] established the feasibility of using digital manufacturing technologies and in particular Rapid Prototyping (RP) for repairing products. The research group took this to a second level in META[morphose] by experimenting the application of RP to the up and side grading of products thus enabling them to evolve [10]. Metacycle configures this technique into an operational framework by creating a virtual community of designers linked by their common interest in the creation of new products from old.



Figure 1: Metacycle.ca, a web site where designers are asked to find a second useful life to old objects: swimming goggles, cell phones, computer mice, etc.

More specifically, Metacycle.ca is a web site that aims to optimize the creative potential of designers by reuniting them within a virtual community serving the common objective of prolonging the life span of consumer products. The goal of this project is to develop an interactive framework through which consumers can benefit from unique and innovative updates to products whose usefulness is being put into question. The pooling of a large number of creative minds allows the generation of a new category of unique products that favour increased attachment through personalization. Essentially, the Metacycle web site challenges creative minds to find solutions for giving a second life to objects that cannot be recycled, for example toothbrushes, VHS cassettes, hockey sticks, computer mice, swimming goggles, computer screens, markers, Walkmans, cell phone, etc. After having chosen a challenge, additional information pertaining to the size, materials and other characteristics of the object is presented with a reminder of the Metacycle guidelines: "Revitalize Functionality, Maximize Reuse, and Reduce Waste and Energy". After having accepted the Creative Commons terms for the non commercial use of their ideas, users can submit their images, models and/or instruction manuals. This content is automatically uploaded into the Explore Ideas section for others to browse and vote upon. If ever an idea gathers a large amount of positive feedback, the Metacycle team will promote it into the third and final section of the Design Lab labeled Featured Solutions.

3. Applying the Metacycle principles

Presenting this Metacycle research project brought students to understand the importance of recuperation for its environmental benefits. They also realize the creative challenge associated with the objective of extending the life span of old objects. While examining closer all the objects around them that end up being discarded, they recognize the design efforts that are behind the creation of these objects and discover the cultural and historical value of those objects, like as archaeologists discovering, examining and preserving precious artifacts. Indeed, beyond the benefits of recuperation from a strictly environmental point of view, there can also be cultural benefits behind such a strategy. With these objectives in mind, a project was prepared for senior design students aiming to address the global notion of sustainability, from an environmental, socio-cultural and economical perspective. The assignment was entitled "A Tribute to Charles and Ray Eames" as the challenge consisted of creating a base for seats salvaged during the renovation of university amphitheaters, which were recuperated just before their disposal. Those seats were actually chairs shells supported by a steel post, as they were previously bolted on metal structures and fixed to the floor (Figure 2). Inspired by the DSR (Dining *Height Side Chair Rod Base*), a famous chair designed in the early 1950's by two of the most innovative American designers of the 20th century, Ray and Charles Eames, those seats are made in fiberglass, an extremely durable material that otherwise cannot be recycled.



Figure 2. The challenge was to design a base for salvaged seats, recuperated during the renovation of university amphitheaters. The model is inspired by a famous chair designed by Charles and Ray Eames in the 1950's.

Each team of two students was given a fiberglass shell and had to develop a support system (legs, structural system or central post) with the material of their choice (wood or metal). The base had to be built to scale and attached to the seat without any modification of the original shell. Therefore, students were not allowed to drill holes or to glue any elements on the fiberglass chair in order to preserve the integrity of the original design. They could however use the existing metal structure to which the seats were fixed or attach their base by using the four threaded rods protruding through the shell under the seat. The structure needed to be solid enough to support at least 100kg and be perfectly functional. The project also had to be developed according to sustainability principles, as indicated in the outline:

"All the projects generated must integrate the fundamental notions of sustainability: favoring local materials and production, reducing parts and costs, designing for disassembly, designing for repair and longevity, avoiding the use of toxic materials, glues, paints and finishes. These principles must be integrated in all the aspects of the design process: limiting the printing, using eco-friendly materials for the construction of preliminary mock-ups and final prototype".

The first step for this project was to bring students to better discover the original Eames concept and the richness of the designers' vision before giving them the occasion to bring a new life to an icon of modern design (Figure 3). Charles Eames (1907–1978) and Ray Kaiser Eames (1912–1988) are known to having given shape to America's twentieth century. Their lives and work represented the nation's defining movements: the West Coast's coming-of-age, the economy's shift from making goods to producing information, and the global expansion of American culture. The Eameses embraced the era's visionary concept of modern design as an agent of social change, elevating it to a national agenda. Their evolution from furniture designers to cultural ambassadors demonstrated their boundless talents and the overlap of their interests with those of their country. In a rare era of shared objectives, the Eameses partnered with the federal government and the country's top businesses to lead the charge to modernize post-war America.



Figure 3. Here is a sample of the furniture designed by Charles and Ray Eames. Many of their creations have become icons of 20th century American modern design.

The students were asked to do a complete research about the designers, and to study their work in the areas of furniture, architecture, film, art and exhibition design. Following the research phase (Figure 4), students explored conceptual and creative avenues through sketches and preliminary cardboard mock-ups, which were presented in class and discussed during the critiques (Figure 5).



Figure 4: In their presentation, students had to address the historical context, the design philosophy of the famous designers and describe the conceptual framework for their creative intervention. Students: Gabrielle Turcotte and Zachary Kain.



Figure 5: Students prepared sketches to present their brainstorming sessions in the studio. Students: Vivien Leung and Levi Bruce.



Figure 6: Exploration of different concepts through cardboard mock-ups. Different iterations were developed to test the solidity of the structure and evaluate the aesthetic proportions.

4. The Results

It has been quite impressive to see the level of commitment and energy the students have spent on this project. What made the experience even more satisfying was to see the level of innovation and creativity that has been expressed through the various solutions. In fact, each of the twelve different concepts developed in class was distinct from the others and every concept focused on a unique structural solution and fabrication method, which led to an extremely rich array of aesthetic and functional approaches (Figure 7).



Figure 7: Images show a sample of the different creative concepts that have been developed by the students. (a): Rodolfo Martinez and Alexandre Théroux; (b): Jeffrey Bush and Alexis Pautasso; (c): Vivien Leung and Levi Bruce; (d): Kyle Goforth and Dacia Pantelis.

In the four examples presented in Figure 7, we note that the version (a) is based on a braced wooden structure fixed directly to the chair as the version (b) uses the central post to support it, allowing the chair to rotate. The version (c) is also unique, as it is inspired by the Japanese traditional culture, where people sit lower to the ground. The metal structure gives the option of sitting straight or leaning back for additional comfort. The other version presented (d) is a rocking chair, which can turn into a normal chair when the legs are inverted. When developing their concepts, students have learnt to develop essential design skills; and while studying the furniture designed by the Eameses, they had the opportunity to understand chair structures and the physical principles applied in furniture. Because the chairs had to be functional, the students were challenged to use a rigorous process in order to precisely determine the height of the seating position, evaluate the amount of material needed, choose the fabrication method and develop their design according to the technologies that were accessible to them. Following the Metacycle principles, students were encouraged to exploit the potential of computer assisted design (CAD)

and the precision of the computer numerical control (CNC) milling machine. By doing so, they successfully integrated and assimilated abstract theoretical notions and technical knowledge through practical experimentation.

To showcase the projects and to celebrate the unique quality of the concepts, an exhibition of the work was presented in the Faculty of Fine Arts' Gallery. This brought a great deal of exposure to the students and contributed to their sense of pride as the expo received many positive comments from the university community.

5. Conclusion

The objective of this project was to develop a strategy to raise awareness concerning both environmental issues and cultural issues with regard to the design practice. By presenting the work of the Metacycle research group, students were led to understand the challenge behind the need to extend the useful life of products. They were called to see the world of objects not strictly in terms of consumer goods, but also in terms of a cultural heritage that needs to be preserved. This project proved to be remarkably successful, the challenging assignment stimulated students to understand the Eameses unique vision and to deeply engage in the development of high quality designs, creative concepts and innovative breakthroughs. It also encouraged the students and the community at large who have been exposed to the projects, to become more aware of the value of many objects that are too often discarded without any concerns for the environmental impacts and too little consideration for the cultural richness that disappears when products reaching their useful life are thrown out. Design, as a creative activity, has the potential to add value to what is too often considered useless. Design researchers and educators should play a leading role in moving forward towards sustainability, which requires the reconciliation of the environmental dimension, with the cultural, the social and the economic dimensions. Too often this view expresses the idea that the pillars of sustainability are mutually exclusive, they should to the contrary mutually reinforce each other.

6. References

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