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Researching the Sustainable Possibilities of Glass as a Creative Material

INTRODUCTION

This paper explores how glass as both a recyclable material and a creative artistic material contributes to the sustainable development. More specifically, this paper discusses how glass artists and makers reuse and recover glass materials that could enhance the artistic and recycling capabilities of glass materials. Environmental crisis is proved by the scientific evidence that we have to take action as quickly as possible; the earlier we response effectively and efficiently, the less environmental impact we and our descendants confront (Stern, 2006, McDonough and Braungart, 2009). On the one hand, we are currently looking for methods to solve the problems of the global climate changes; on the other hand, the ethical imperative within public has to be encouraged from passively adapt to sustainability, to actively devote to sustainability (Blackburn, 2001).

This paper begins with investigating the studio base movement, and find out the glass making changes from industrial factory glass production to individual studio base creative activities. Glass can be seen as a material with excellent industrial and functional attributes, which delivers rigidity, brilliance, clarity and various colour ranges. With the development of glass techniques, artists and craftsmen have opportunities to operate some hot forming processes in their studio. These creative opportunities flourished the glass art and provided glass with a wider context to show its artistic and aesthetic attributes and attractions.

The second section looks at the development of sustainability that aims to provide an overarching context to this research. Recycling is brought out from the sustainable ideology, in order to discuss the current glass recycling activities. Recycling is a tangible practice that rescues usable materials from the waste stream.

The third section reviews the case studies of glass recycling in order to clarify effect of glass as an artistic material. This section also investigates the limitations and opportunities of utilising glass materials.

The forth section looks at how art works or products influence recycling activities in the public. Artefacts or products have their physical functions as well as emotional functions. Glass recycling in public sector is known to be a voluntary activity; how it could motivate public to recycle waste glass is investigated.

In summary, the paper proposes ways to address the problems in reusing glass as an artistic material, which in order to encourage sustainable ways for glass making and other creative activities. Making futures is a commitment, a responsibility that creative thinkers and practitioners should take. Art is able to encourage awareness of our unsustainable practices by creating artefact to challenge our conscience and attitude to the environment.

STUDIO GLASS

This section reviews the history of studio glass along with investigation into the cognition of how glass shift from a pure industrial material to an artistic expressive medium.

Although, studio glass is used to differentiate factory based glass productions and studio based artistic activities, 'studio glass' is not widely used until 1960s American studio glass movement. Terminologically, 'studio glass' is known to be coined by Harvey K. Littleton who primarily determined free-blown glass is true 'studio glass' (Lynn, 2004). Littleton is regarded as the founder of the studio glass movement who combined studio and glass with his experimental practice. However, Littleton first used studio and glass as

separate terms which delivers message where the glass was made (Warnus, 1998). With the development of studio glass movement, the techniques of studio glass have been developed by a number of practitioners and makers comprising cold-worked glass, warm glass, and hot glass.

Historically, glass is known to be an excellent material which is widely used for producing containers, optic media, insulating products etc. Glass has remarkable mechanic properties, for example: it is several times stronger than steel, yet can be made into transparency. The chemical properties of glass are good enough to contain wide range of contents without contaminating them. Before the Industrial Revolution, glass was mainly handmade. For example, window was made by shearing the hand-brown glass cylinder or rotating the glass crown. Until nineteenth century, when techniques were ripe enough for mass producing glass, glass was then predominately produced in modern factory (Lynn, 2004). The advantages of machine made glass production fast, uniformed, and meeting the aim of mass production. Glass makers and craftsmen contributed to the technological development massively, especially from their creativity. Cummings (2009: 63) indicated, 'Glass by its nature is mysterious, attractive material with a unique range of forming processes and tools.' And Littleton said 'Technique is Cheap' which intimated that glass making should express the real beauty of glass by any viable technique. This idea drove studio glass movement across over half century (Warnus, 1998).

For the origin of studio glass movement, Littleton contributed to giving this unique material a new life which has been share by a number of artists and makers who willing to take it on. Warnus (1998) summarised the idea of Littleton who believes, '... glass is like that: Strength and fragility. Risk and containment.' This quotation indicates studio glass artists confront both risk and chance. On the one hand, malting glass or casting glass requires enormous energy input, gas and electricity. On the other hand, although raw ingredients for making glass are widely available and inexpensive, glass artists do not have chance and facility to produce glass from basic stage. They tend to buy ready made glass cullet for kiln casting, or ready made glass batch for supplying glass blowing furnace. However, glass is known to have excellent ability on recycling. Evidences show that, reusing or recycling glass material could largely save energy, and recycled glass has potential to take the place of conventional artistic glass materials.

The following discussion of this paper focuses on: 1), how do artists and designers reuse and recycle waste glass as an artistic material or productive material? 2), how does recycled glass product survive in this profit orientated commercial environment? 3), how do public react with waste glass products?

SUSTAINABILITY AND RECYCLING

In order to adapt to the main theme of Making Futures conference, it is necessary to investigate the concept of sustainability and recycling.

Sustainability

The origin of sustainability is regarded as naturally, because early agricultural communities have already adapted the principle of 'law of return' to their planting and farming activities, 'which simply meant that the farmer should try to repay the earth for what he took from it' (McDonough and Braungart 2009: 4). It could be seen that, in the pre-industrial age, the relationship between the nature and mankind was comparatively harmonious and sustainable. However, the development of technology provides human beings with power and abilities to alter the environment and excavate resources from the earth. Although nature has its resources restore process namely Biological Metabolisms, the rate of excavation is much quicker than nature restores (McDonough and Braungart, 2009). Papanek (1985) indicated earlier, 'Mankind is unique among animals in its relationship to the environment. All other animals adapt autoplastically to a changing environment; only mankind transforms earth itself to suit its needs and wants alloplastically.' Bosselmann (2008: 21) have reasoned why some people are less

immediately affected by environmental impact, it is because '...the distance in space (global environment) and time (future generations) prevent us from acting with urgency.' Historically, since the climate change affected our living environment in the stage of Industrial Revolution, the cognition of sustainability has been raised by a handful of ecologist and environmental activists. However, we have not evidently witnessed the seriousness of the crisis until the publication of Rachel Carson's silent spring (Carson, 1962). Silent spring is a remarkable book which is known as the first book challenged our conscience and attitude to the nature. With appreciation of nature and the scientific concern, Carson explained that human-made chemicals (particularly pesticides such as DDT) were destroying the natural world, especially the sustainable capability of certain bird species (Carson, 1962). This book has received broad responses and directly facilitated the legal prohibition of using DDT in 1972 in the USA.

In 1980's, after a report named Our Common Future was published by World Commission on Environment and Development, sustainable development started to draw wider global attention. In this report sustainability is defined as: '...meeting the needs of the present without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development, 1987; Dernbach, 2001). The awareness of sustainability provides common recognition how we could maintain a harmonious and long lasting society and environment.

However, the economic growth and sustainability is usually regarded as a set of counterpart. Stern, a British economist used 'an urgent global response' to begin his review on current environmental crisis and climate change (Stern, 2006). Stern believes the globe is facing a severe crisis on climate change, energy depletion and over development. A strong action and international co-operation should be taken to relieve these impacts as soon as possible; the sooner response is act, the less severe consequences will be met in the future. Stern suggested three elements of policy for relieving the impact of climate change: 1), establishing a global carbon pricing structure; 2), encouraging development of low-carbon and high efficiency technologies; 3), removing barriers of behavioural change (Stern, 2006). In this sense, sustainability is achieved by the joint effort of legislation, physical/technological innovation, and ethical change. Legislation varies nation to nation, and the problems in technological innovation and removal of behavioural barriers are reality to discuss in this paper.

Physical environment is fragile and we have been educated to become sensitive to its change. Environmentalist McDonough and Braungart indicated that mankind needs to learn from nature to emulate it and to re-establish the harmony with nature. They described nature is a cycle of Biological Metabolisms which is considered as a closed loop cycling system, where '... major nutrients – carbon, hydrogen, oxygen, nitrogen - are cycled and recycled' (McDonough and Braungart, 2009: 92). This system used every single element in nature, the form and properties change from one natural body to another by the force of nature, and this force maintains the properties of these elements and balances nature. On the other hand, McDonough and Braungart introduced the idea of 'Technical Metabolisms' that imitates the natural 'Biological Metabolisms' (McDonough and Braungart, 2009: 92). Technical Metabolisms is an optimised industrial material recycling loop that waste materials could be reabsorbed, reuse and recycle again. Cradle to cradle provides a thorough description of how Biological Metabolisms work in nature sphere. And, McDonough and Braungart introduced certain practical approaches how we could creatively learn from nature to establish industrial Technical Metabolisms. Recycling industrial products can be seen as one aspect of industrial Technical Metabolisms.

Recycling

The definition of recycling is interpreted by a number of researchers and practitioners according to different purposes. Barton concluded these interpretations that recycling refers to '... the return of a discarded material or article to the same product system'

(Barton, 1979: 3).

In practice, recycling can be seen as a tangible sustainable practice, which aims to rescue usable materials from the waste stream. The idea of Technical Metabolisms could provide some guidelines to current recycling practice. Glass recycling in particular, there are certain problems in the practical operation: firstly, the glass recycling system is not effective as we expect. In another words, throwing glass bottles into the recycling bins does not stop them end their life in the landfill. Secondly, there is lack of the public's sustainable/recycling awareness. Public consider sustainability and recycling is good for our environment, but '... nobody seems to know much about it' (Bosselmann, 2008: 20). To raise a simple example, we all know putting glass bottles into the recycling bins could contribute to waste sorting. However, few people obey the instruction to remove contaminant which could directly damage the quality of recycled glass.

Researching glass recycling provides me with an opportunity to rethink the position and responsibility of a designer. Generally speaking, recycling is how human gently response to certain substances which have no immediate value to human beings (Birkeland, 2000: 43). If sustainability is as an immaterial attitude and direction that engages with the long-term development of our world, recycling is a materialised practical sustainable activity to rescue unwanted material from the waste stream. Recycling could be undertaken by various means, in terms of recovering materials back to their original forms, the breakdown of material for alternative use, or the mixing of materials to create new functional products. As a matter of fact, it is necessary to understand various forms of recycling that contribute to sustainability. However, we need to recognise that not all the recycling is sustainable enough, in terms of certain applications downgrade properties and functionalities of glass material. In this research, I aim to optimise glass recycling to be a cradle-to-cradle recycling with the perspective of a designer.

In summary, sustainability is a way to maintain the futures that is one of the main purposes of this conference. Recycling is one of many available methods that retains sustainable development without losing valuable resources.

POSSIBILITIES OF USING RECYCLED GLASS AS ARTISTIC MATERIALS

Previous section focuses basic concept of sustainability and recycling, this section looks at some samples of reusing and recycling glass as artistic and constructional materials.

What can artists and designers do for sustainability? Designers can make a difference, Mackenzie (1997: 68) claimed, '... they determine the choice of materials; how long the product will last; how effectively it uses energy, and how easily it may be reclaimed and re-used.' How could recycling glass make a difference? What is the way to sustainability? This is a conceptual question which could be answered from different perspective according to different disciplines. '...sustainability reflects pure necessity' (Bosselmann, 2008: 20). Design is one of the creative practices to represent the way to sustainability, because design has the dominant position that directly affect the effectiveness of products and their life cycle. Warnus (1995) indicated, when the history of studio glass is written, significant accomplishments will include the growth of a community, the emergence within this community of innovative approaches to the marketplace, and the cultivation of maximum diversity within the medium itself.

Historically, glass used to design as returnable and recyclable, and the recycling rate was relatively high; it is partly because deposit was added to these returnable glass bottles. However, glass bottles were made to be throwaway containers, Barton (1979: 118) indicated, 'this was not done because of bottle fragility or cost, but was in response to a change of consumer habits brought about by advertising and made possible by increasing public affluence.' As a commerce and industry related creative activity, design is now more than a graphic based work, which embraces users' need analysis, market research, problems-solving, productivity enhancement. Brown (2008: 2) claimed that 'a

designer uses his sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity'.

The following case studies can partly provide the possibilities that art and design influence glass recycling.

Heineken WOBO project

Although WOBO project does not seem to be a studio glass movement activity, Heineken provided a creative example of turning throwaway container into usable creative materials. The idea of Heineken WOBO project was originated from Alfred Frederick Heineken's trip to Curaçao, who saw hundreds of green glass bottles littered the beaches. There were lack of building materials in the island of Curaçao, therefore, Heineken considered it might be an good idea to use bottles as building materials (Pawley, 1975). A young architect John Habraken was appointed to undertake this job. The final design is a bottle that is thicker (comparing to regular bottle), nearly rectangular, and more like a regular brick, to be stacked horizontally. (Image 1) The advantage of this design was firstly, the neck was shorter, and fit into a depression in the bottom of the next bottle. Secondly, the necks faced in different directions in alternating course to create a bond. Thirdly, two sides were covered in small bumps for better grip, but thin layer of mortar was needed. Fourthly, the empty bottles could be stuffed with insulating materials like Styrofoam etc., for the lighting and secure requirement (Pawley, 1975).



Image 1 John Haraken, 1963, WOBO, Photograph courtesy to John Habraken

However, this project discontinued because of reluctances from bottle manufacture and Heineken marketing advisors who pointed out these bottles are lack of economic feasibility. Some design problems are found by analysing the design of bottle. 1), rectangular bottle: the problem with rectangular bottle is the capability in internal pressure which is relatively weak compare to conventional cylindrical bottle. Therefore, the WOBO bottle had to be designed with a much thicker wall which on the one hand requires more glass to make, on the other hand makes bottle very heavy. 2), square shoulder shape: Barton analysed the vertical load pressure resistance on different bottle shape and found the square shoulder shape performs relative worse capability of resistance. WOBO bottle is shaped as a square shoulder shape. This is the other reason why WOBO bottle is thicker than regular bottle.

All these factors increased the energy expenditure of manufacturing and transporting WOBO bottle. Although WOBO project failed to sustain, it provided a direction that glass bottle could be designed.

A bottle is a messenger

'A bottle is a messenger' (image 2, 3) is the title of my MA project that explored the communication between audience and the artefact. In this project bottles were regarded as new bodies of containers that carry not merely tangible contents such as liquid, but also intangible and empirical ones such as messages and memories. People communicate with each other via messages, and the message spreads via a medium or a container. For example, when a person is trapped in an island, one of the ways the person calls for help is to put a letter into a bottle and throw it into the sea. The letter could finally reach the other person, then the communication is made and the trapped person could get rescued. In this project, binary digits '0' and '1' were used to interpret love and hope. Love and hope are intangible while able to be experienced and expressed though interaction. These digits were enamelled onto the surface of the bottles to create interest and message that audience would like to know about. This series of work symbolise the message translating and transforming, which were proposed to create an atmosphere between audiences and artefacts.

In this project, waste glass was used as a creative vehicle to carry my ideas, and emotion on admiring glass. Norman (2004: 7) has commented on the emotional feeling on interaction with object, which'... always has a story, a remembrance and something ties us personally to this particular object, this particular thing.'



Image 2 Xin Li, 2008, a bottle is a messenger, Photograph courtesy to Xin Li

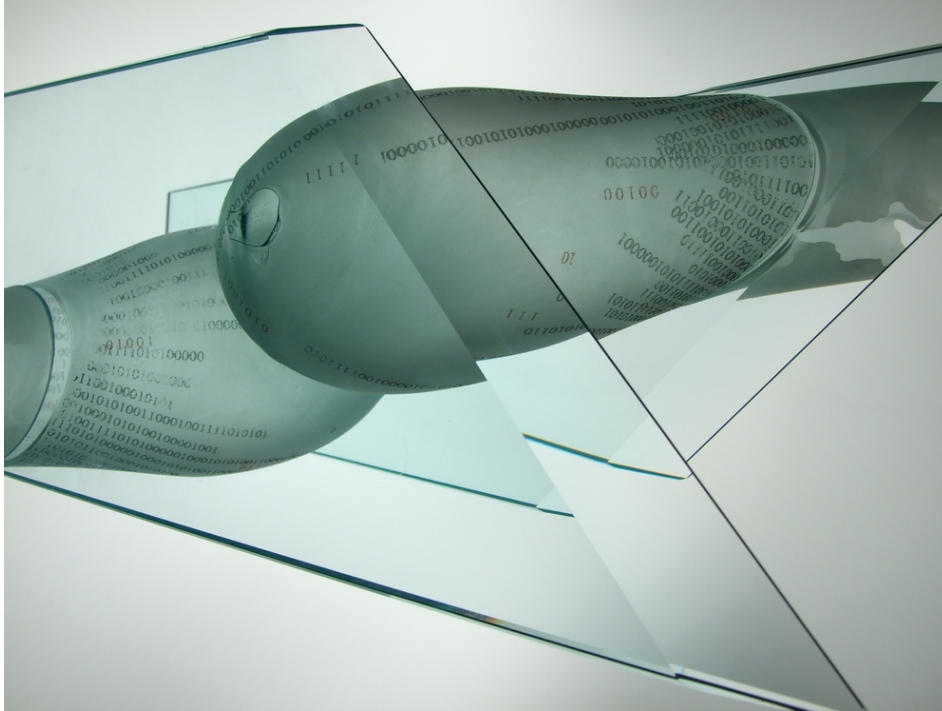


Image 3 Xin Li, 2008, a bottle is a messenger, Photograph courtesy to Xin Li

In summary, waste glass can be used to reflect the beliefs of natural harmony. On the other hand, waste glass could be transformed to a creative medium carries devotion to sustainability.

THE ETHICAL IMPERATIVE OF SUSTAINABILITY

One of the difficulties for people who are willing to participate in voluntary recycling is identification of high and low quality of recyclable materials. In glass recycling, public is given ambiguous instructions on identifying glass, which lead to glass types and colour mixing. This contamination can make the cullet being rejected by container manufacturers. It is recognised that one of the problems is lack of urgency to recycle material from waste. How does design encourage this awareness? Norman explained our behaviour is driven by cognition and emotion. Cognition, on the one hand, makes judgement rationally with logical consideration. On the other hand, emotion provides fast responses and reactions, which determines our common behaviours and awareness. (Norman, 2004)

It is approved that human society is built on devastation of nature, while embarrassingly human beings live depend on the balance and harmony of nature. Although we could sometimes physically move away from the polluted environment for example the area of high nuclear radiation, we could not escape from the ethical environment. The ethical environment is defined as "... the surrounding climate of ideas about how to live.' (Blackburn, 2001, p1) The ethical environment determines our behaviour and response to the physical environment, which could be simply described as being good to our environment. The notion of being good to our environment is the ethical drive of sustainability.

If a user/consumer learns a product well and by which materials it made, the user would react differently with this product. Glass has a long tradition that represents craftsmanship, immortality, stiffness and worthiness. Think of Venetian glass, Lalique glassware, Tiffany glass, these articles sometime outweigh the value of noble metal. (Ashby and Johnson, 2002: 75) Commoditised glass still carries some technical

attributes, such as durability, clarity, stiffness, however people lose the association with quality, elegant, norm etc.

We should recognise that materials do not have 'built-in obsolescence', however products do. 'We interact with materials through products' (Ashby and Johnson, 2002: 73) the interaction involves their technical and aesthetic attributes but these are not all. A product has perceived attributes and associations which give it its personality, something designers work hard to create. Artefacts or products have their physical functions as well as emotional functions. 'Some objects evoke strong, positive emotions such as love, attachment, and happiness.' (Norman, 2004: 7) 'Emotions, we now know, change the way the human mind solves problems the emotional system changes how the cognitive system operates.' (Norman, 2004: 18)

Although full closed loop recycling is an ideal sustainable recovery of material, 100 percent recycling could be infeasible for practical and technical reasons. (Barton, 1979) It is necessary to make recycling rate quantifiable and setup a standard of convincing recycling rate on particular material.

In conclusion, joint effort of society, technology and design is needed in order to motivate public to perform better recycling behaviour and remove behavioural barriers. However, art and design play important roles here to encourage ethical imperative through artefacts and products.

CONCLUSION:

This paper has integrated different areas of knowledge together, in terms of studio glass movement, sustainability, recycling glass as artistic material, ethical imperative of public. In response to the conference theme and particular glass workshop, glass is used as a medium to communicate. The findings of this research show how waste glass can be used as a creative material to stimulate the effectiveness of sustainable design, and on the other hand encourage the willingness of public to change their unsustainable lifestyle. This paper is a part of my PhD research, and further research and investigation are undertaken.

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