# PLASTIC POLLUTION

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#### **INTRODUCTION**

Plastic pollution is a kinetic sculpture that demonstrates the global outcomes resulting from the usage of plastic pollution. Since plastic has a variety of advantages in its versatility, lightweight and flexibility, the relative inexpensive cost has caused the over use of plastic products to flourish while disregarding the pollution to the world (Claire Le Guern Lytle, 2012). It is clear that the over-consuming behaviors of plastic has led to discarding, littering and polluting nature. According to Ocean Conservancy reported in 2010, 2.5 billion metric tons of solid plastic wastes exists in the oceans today and 8 million metric tons of plastics pollution are dumped in oceans around the world each year ("New Study on Ocean Trash," 2010). Furthermore, Plastic Oceans Foundation demonstrates that over 600 species of marine life are known to suffer directly from plastic pollution and over 90 percent of seabirds have plastic pieces in their stomachs. Nonetheless, the "Forecast for the World Plastics Industry to 2020" estimates that the plastic production will reach 400 million metric tons compared to 299 million tons in 2013 (Francoise Pardos, 1999). Which means if we do not change the attitude toward plastic pollution, our Earth will be overwhelmed with plastic wastes. Therefore, this kinetic sculpture is designed to make aware of plastic pollution in hopes to stop the use of disposable plastic products and ensure more recycling to save planet-Earth before it is too late.

### **CONCEPT AND BACKGROUND**

#### **Plastic Products**

After seeing cruel pictures of wild animals suffering from plastic waste, it is disappointing and astonishing that human beings are responsible for so much pollution and devastation around the world. According to Greenpeace International investigation, 6 out of 7, or 86 percent of sea turtles worldwide have been found entangled and 50 percent ingesting plastics. Moreover, 40,000 seals a year are being killed by plastic entanglements (Derraik, 2002). What is worse is that most people are not aware that the continuous pollution of plastic products, thus plastic consumption is now escalating. Furthermore, since human beings are on top of the food chain, those animals consuming plastic products end up in humans stomach, and thus adversely affect themselves (Eliza Barclay, 2013). As a result, I desire to increase people's awareness of plastic pollution hoping that they will change their behaviors of plastic production. But even if we realize these conditions, companies or governments do not reduce the amount of plastics production; instead, the estimated amount of plastic production worldwide has surmounted up to 400 million tons in 2020 since demand has dramatically escalated ("Forecast for the World Plastics Industry to 2020," 2013).



Figure 1. This mind map is a brainstorm of the relationship between Pollution and Plastic Products.



Figure 2. Research of relationship between Plastic Products, GDP per capita and the price of Plastics (Paulo Moretti, 2014).

Part of the reasons plastic has become more popular could be that, in 2012, the overall plastic industry accounted for 1.4 million jobs in the European Union and had a combined turnover of above 300 billion euro, making growth of GDP in Europe ("Plastics-the Facts 2013," 2013). This report claimed that plastic has become one of the most universally used and multipurpose material thus deeply affecting modern global economy. In addition, plastics have become an essential part of our modern lifestyle such as LCD screen, touch-screen on smartphones and tablets, helmets, balls and so forth, making its market larger and larger ("Plastics-the Facts 2013," 2013). Furthermore, one of the most adverse plastic products is plastic bag. Over 1 trillion plastic bags are used every year in this world which means about 1 million plastic bags are used in one minute (Lisa Madarasz, 2013). Besides, industry figures

show 90% of all grocery bags are plastic with only 1-3% of plastic bags recycled worldwide. And it takes 1000 years for those bags to break down or degrade, causing 1 billion seabirds and mammals dying each year (Facts About Plastic Bag Use, 2013). However, even though the governments in different countries have been promoting plastic bag bans, it does not significantly decrease the amounts of plastic bag usages. One of the reasons for this could be that no penalties are executed if shoppers remain using plastic bags, thus, compliance is not required. Although using reusable bags is a simple behavioral change, it seems that reducing land fill and plastic pollution are not big enough a reason for the majority to change, since, there are no immediate tangible benefit to them except for a greedy behavior where corporate businesses gain monetary value (Paul, 2011). Therefore, awareness is the first change to human behavior to effectively reduce usage of plastic bags all over the world.



Figure 3. The Disadvantages of Plastic Bags describes how plastic bags are fatal and harmful to our environment. Plastic bags can cause unmitigated catastrophes to the next generation.

#### The power of Sound

In this project, sound is used as a medium to attract people's attention and interest since it plays a vital role in our daily lives by aiding understanding and meaning to expression. According to the Anstendig Institute, impressions obtained through two senses (seeing and hearing) are as much a necessary human nourishment as food and water ("The importance of sound in our lives," 1988). Besides, the infinity of visual possibilities is joined with the infinity of acoustic possibilities to create meaningful relations (Guy Stanley, 2009). Furthermore, it shows that music may be particularly effective in stimulating mental imagery (Osborne, 1980; Quittner & Glueckauf, 1983), and several studies also indicate that imagery can be effective in enhancing emotional reactions to music in listeners (Band, Quilter, & Miller, 2001-2002). Therefore, by adding sound, the plastic pollution sculpture is able to enhance the impression about plastic pollution on viewers, allowing them to imagine the connection between catastrophic content of sound and kinetic movement of installation. And

thus these facts and tragedies would not be easily forgotten and ignored by folks, perhaps imprinted, so people may change their behaviors of using plastic bags.

# DESIGN

In this sculpture, I devised 3 elements, elongated plastic screws, wired globe, and sound to symbolize the destruction of plastic pollution on earth. First, the elongated plastic screws inserted onto the globe, symbolizes devastation of plastic wastes on Earth. Second, black dots placed on the wired globe represent plastic wastes overwhelming our ocean. Lastly, sounds of news facts on plastic pollution killing innocent animals. This sculpture desired to attract audience's attention that we should immediately take action to change our consuming behaviors of plastic bags through the destructing movement of plastic pillars, covering with black dots, and operating sounds.



Figure 4. These inspiration diagrams discuss that large amounts of animals are suffering from entanglement of plastic pollution, especially in plastic bags. The circle punctured by red arrows represent that plastic pollution causes destruction to Earth. The small icons of plastic products show the diverse usage of plastic in our daily lives. Moreover, the map shows the annual polluting gases that are released from different countries due to plastic.

First, with the variety of plastic products, I chose to utilize enlarged plastic screws to symbolize all plastic products, plastic bags, microbeads (plastic particles less than five millimeters), or bottle caps, because screws similar to these plastic products are minuscular objects unnoticeable in our daily products which reinforce the most crucial parts to any construction. As a result, these insignificant products are littered into nature or environment causing fatal and toxic pollution killing billions of marine wildlife. In order to represent the 12 countries with the most plastic usage, 12 pillars of plastic screws were configured like the countries on earth and attached to rotating kinetic motor gears at the center of the wired globe. As the sculpture is turned on, the rotating speed of 12 pillars were controlled by the motors and programmed to each country's usage of single-use plastic bags per year symbolizing the daily production and operation of plastics in factories that are destroying earth.

Second, the appearance of the wired globe is covered with black plastic dots or bodies allocated in each intersection between latitude and longitude to symbolize the 2.5 billion tons of plastic wastes produced killing countless numbers of marine life. These animals were found with plastic wastes in their stomachs, on their necks, and even in their nostrils.

Consequently, the ocean has become darker and darker, floating with dead animal bodies and plastic wastes. If mankind do not take action to reduce using plastics, one day our ocean would become black colored with unmitigated disasters.

Thirdly, sound of narrations of worldwide news reports were played simultaneously as the motors rotate to signify pollution of plastic bags in ocean and disasters to earth. The sources came from a wide range of videos including news, events, and research from environmental agency and world reports. In addition, propaganda of recycling programs with public announcement of reusable bags or recycling sounds were interstitched to persuade visitors to recycle. Hopefully this sculpture promotes audiences to realize their behaviors of plastic usage and pollution. If everyone can reduce usage of one plastic bag in one minute a million plastic bags can be saved around the world (Nicole D'Alessandro, 2014).



Figure 5. This diagram discusses Plastic Pollution's mechanism; they are divided into three segments —the plastic wastes (globe wired with black dots), production of plastics (screws), and the overall plastic products (plastic pillars). In addition, sounds are added to not only attract audience but also aid viewers to the meaning of this installation.

# **MECHANISM AND CONSTRUCTION**

Plastic Pollution is constructed by using the Arduino system, a software program which controls the Arduino Mega 2560, a microcontroller board with digital input and output pins, analog input pins, UARTs (hardware serial ports), and USB connection. This board receives inputs from sensors and outputs by controlling lights, motors, and other actuators ("Arduino MEGA 2560 Overview," 2013).

To begin, the sounds from external sources are looped to attract visitor's attention into the space. Then, to trigger the sculpture, signals of the ultrasonic sensor detects distance objects in this environment. If the audience walks within 30 centimeters (default value) in front of

the installation, the Arduino program would send default signal to motor driving modules; otherwise, the motors would stop operating and the ultrasonic sensor would keep detecting. When triggered, the motor driving modules of the 12 different pillars would rotate up and down depicting the plastic bag usage in these countries.



*Figure 6. This figure shows the detail structure installation diameter that is 90 centimeters long with how the gears and plastic pillars were controlled by the motors.* 



Figure 7. This diagram describes the operation process of this installation. It utilizes the Arduino program to control the motors, ultrasonic sensor, motor driving modules. Materials: Computer/ Arduino Program/Arduino board/Ultrasonic sensor/Motor drivers/Motors/3D Printer/ABS Texture/ Plastic Pipes/Transformer



Figure 8. This figure shows the steps when constructing this installation. The picture on the left-top shows the prototype of destruction to Earth. The middle one displays the 3D printing process of screws. The right-top picture shows the testing mechanism of motors and plastic pillar.

# FUTURE WORK

In the future, to improve this installation and gain active interaction with audiences, I propose to replace the previous screw-shape plastics with deserted plastic bags differentiated in sizes and adding wires for people to pull to turn on the installation. To begin, the size of each plastic bag represents the consumption of plastic bags in each country. That is, the bigger the plastic bag the more amount of waste it contains, symbolizing the amounts of plastic pollutions released to earth. By using deserted plastic bags it serves to present eco-friendly reuse. Second, when pulling the wire, mercury switch triggers simultaneously both motors to spin and sound to play, allowing plastic bags to be expanded with sounds of news reports on plastic pollution in diverse languages related to its country. So, while seeing the plastic bags expand during installation, audiences are able to realize how different countries have caused different levels of plastic pollution. In addition, this physical interaction of "pulling the wires" symbolizes the action that humans are physically engaging on the behaviors of utilizing plastics in their daily lives, resulting in more plastic bag production all over the world. If audiences would stop pulling the wires, it means that human can stop using plastic bags. Finally, plastic bags remains on earth for hundreds of years while it only take a few

seconds during shopping or carrying things to use and throw away plastic waste; thus, it is necessary for people to stop using single-use plastic bags and start bringing reusable bags with them in order to save our planet.



Figure 9: The figure shows the improvement plans of this installation through adding wires and deserted, reusable plastic bags to add interactive elements to this project.

### CONCLUSION

In conclusion, plastic pollution should be considered as a significant part to all human beings since we have actually thrown away too much plastic rubbish into the ocean and lands harming our atmosphere that we breathe. Plastic bags excrete toxic chemicals into ocean while decomposing fish and birds while marine animals die from ingestion of plastic. Furthermore, toxins are continuously being accumulated in small fishes and then eaten by its predators, in turn, end up in human stomach. However, people are uninformed of this behavior and thus continue to use plastic bags because of its convenience, lightness, and firmness.

One million plastic bags are used every minute, it is necessary for people to address this adverse behavior. As mentioned above, it is a hassle for human to use reusable bags. Hopefully by combining reusable bags with new media arts, people become more aware and willing to bring reusable bags. Perhaps, by utilizing advance technology we can now produce a light, small, and functional reusable bag or start free reusable bags program that circulates around market to give second purpose instead of just single use wastes. Since plastics would not go "away," the most effective way is to change human behavior; after all, it is to benefit the environment and all of us.

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