

# The Plastic Entanglement Trap (P.E.T.)

## Final Report



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## Executive Summary

Plastics in marine ecosystems pose a serious environmental threat which social discourse does not reflect. We believe this is because scientific research and technological production remain an elitist practice which excludes the population at large. Our marine plastics monitoring device, The Plastic Entanglement Trap (P.E.T.) is a technological device which tests for the presence of marine plastics in aquatic settings. The P.E.T. is a relatively in-expensive, portable technology made from household materials. Our technology aims to make scientific practice and research more accessible to publics, so that serious issues like marine plastics may begin to permeate through public discourse and knowledge may begin to spread through publics. We initially tested the P.E.T. in three different settings: a controlled “bathtub” test, an ocean coastline and a barachois. All technology tests were conducted in St. John’s Newfoundland. Preliminary testings of the technology yielded successful results. Our research confirms that the P.E.T. is low-cost, easy-to-move, functioning technology; which can monitor the presence of marine plastics in certain aquatic environments. While our preliminary results on the P.E.T. offer optimistic findings, further research is needed to examine the longevity and durability of this technology.



## **Statement of Problem**

There is a lot of plastic in the ocean and the situation is continuing to worsen. Plastic pollution is a complex problem since plastics do not decompose, and are hard to break down. Plastic is used to make many of the items we buy or use today and the resulting quantity of plastic waste, which often finds its way into our oceans, is steadily increasing. The problem arises when we no longer want or need these items. How we dispose of them demands effort and diligence. Plastics are used because they are lightweight, strong, durable, cheap and extremely versatile. Unfortunately, most of these same useful qualities can make plastics a serious hazard to the environment. The cheapness means plastic gets discarded easily. The long life means it survives in the environment for long periods where it can do great harm. (Derraik, 2002, p.842)

The plastics that pollute oceans and other waterways have severe impacts on our environment. There are long-term impacts involved when plastics are consumed by fish and other marine life. These impacts even have potential effects on human health. “From what started as a perceived aesthetic problem of plastics littering towns, countryside, shores and even far out into the ocean soon emerged as causing the choking and entanglement of wildlife” (Barnes, 2009 p.1986). “Once an animal is entangled, it may drown, have its ability to catch food or to avoid predators impaired, or incur wounds from abrasive or cutting action of attached debris” (Derraik, 2002, p.846). As our technology is a Plastic Entanglement Technology (P.E.T.), our hope is that it not only derives plastic samples but also brings awareness to how easy it is for plastics to cause harm by getting entangled in ecosystems.

In Winner’s article *Do Artifacts Have Politics*, he argues “Consciously or not, deliberately or inadvertently, societies choose structures for technologies that influence how people are going to work, communicate, travel, consume, and so forth over a very long time. In the processes by which structuring decisions are made, different people are differently situated and possess unequal degrees of power as well as unequal levels of awareness” (Winner, 1980, p.127). In the design and use of the P.E.T., we kept in mind the politics of our technology. People may be aware of ocean plastics as an environmental issue, but do not have detailed information on what those issues are.

We believe there is a gap in knowledge surrounding marine plastics because scientific technology and research is an elitist, privatized practice which excludes the general population of society. The politics embedded in scientific technology label trained professionals as “experts”, discarding the rest of society as incapable bystanders. Therefore, social problems which can be realized through scientific practice, such as the threat of marine plastics, often remain outside of general social discourse. It is important to raise awareness and educate the public, so that they are informed about the issues marine plastics cause and the possible solutions to this problem. Awareness of these issues can potentially lead to the general population (the plastic consumers) playing a role in the solution, as the permeation of issues through society allows knowledge surrounding an issue to become comprehensive and robust. Having access to instructions on how to affordably make a Do-It-Yourself (DIY) marine plastics technology will enable the general public to create their own P.E.T. The P.E.T. challenges hierarchical barriers and general social discourse, so that marine monitoring technologies are accessible to people of various social positions; not just professionally trained, elitist researchers.

## **Methodology**

### **The Design**

The Plastic Entanglement Trap, or P.E.T. for short, is designed to be made out of household items that can be recycled all while being portable, and accessible. The technology is made out of three essential parts; a bag, balls and an anchor.

### **How It Works**

The P.E.T. is an ocean plastic monitoring device that is based around filtering plastics through all of its containing materials. The mesh bag and its containing balls are all constructed out of materials that can easily filter water and plastics. The technology is anchored in the water and rests floating on the surface near a shoreline, where plastics are commonly found. Water enters the technology from all angles, of the mesh bag and into where the balls are found. These two areas of the technology, the bag and the balls, are where ocean plastics are to entangle. The P.E.T. is designed to be light and portable so it can be easily transported to, from and around the water.

### **Differentiation**

The P.E.T. differs from other methods of measuring ocean plastics because, as mentioned, it is specific to the subject of accessibility. Other ocean plastic monitoring devices are not only complicated to make but can end up becoming very expensive projects. The P.E.T. can be made out of multiple different variations of household items found in kitchens or bathrooms or can be bought for inexpensive amounts at stores similar to Walmart, the Dollar Store and Pipers. The design layout and guidelines are simple and easy to follow. Visual aids and diagrams are provided in its brochure to ensure its simplicity. The P.E.T. is also designed to work overtime and requires little to no physical labour. Other technologies can be heavy and difficult to transport and may require them to be trawled and pulled in the water, whereas the P.E.T is naturally moved by the ocean itself. Instead of trawling the technology, the waves of the ocean are used to mix and naturally filter its containing plastics through the technology. The technology can also be left by itself in open waters without consistent monitoring. Users can choose to deploy, check-in and pick up their technology whenever they please. It can be used and organized around the user's alternative schedules. The P.E.T. is a technology that is based around accessibility. This includes its inexpensive, portable and easy-to-use characteristics.

**Materials consist of (but are not limited to):**

For the bag/sac:

- A mesh laundry bag
- A net garbage cover
- A fruit bag

For the balls:

- Plastic dish scrubbies
- Steel wool scrubber
- Loofas
- Pantyhose
- Sponge

For the anchor:

- Pillowcases
- Burlap or a sustainable bag
- Rope
- Rocks
- Reusable grocery bag

Others:

- Scissors
- Small zip-ties
- Large zip-ties
- A luggage tag
- Elastics

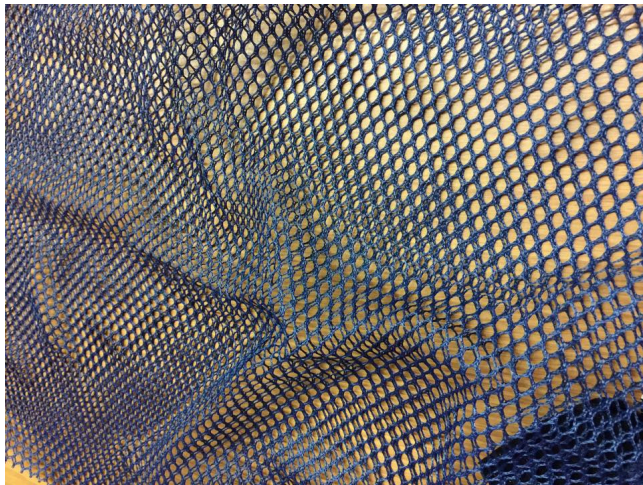
The P.E.T. consists of household materials that may already be owned and can be recycled/re-used or bought for inexpensive amounts.



## How to Make a P.E.T.

### Step 1: Create the bag

Choose a material to act as your technology's exterior. I.e. half of a laundry bag based on its size. The material should be made out of mesh or a fabric that will let plastics and water pass through. The original P.E.T.'s bag was constructed out of a laundry bag. The user should make sure the bag is big enough to contain 5 balls. (Baseballs can be used to compare/ estimate size). A recommended size is 60cm x 45cm.



### Step 2: Make your balls

The balls have two layers two them. In the original design the outside layer is made out steel wool and the inside layer is an intact plastic scrubber. Users should pull apart their outside layer, in this case the steel wool, and wrap it around the base layer, which is in this case the plastic scrubby. Others materials that can be used include loofahs, pantyhose's and sponges. Both layers acts as entanglement and filtration devices.



### Step 3: Secure your balls

It is important that your outside layer stay attached to the base layer. To do so one can use small zip ties to attach the two together. Puncture the tie through both layers then lock it to itself, making it secure. This is done to prevent the balls from unravelling and coming apart. Other materials that can be used instead of zip ties include elastics and bobby pins that can be manipulated into securing the layers together.



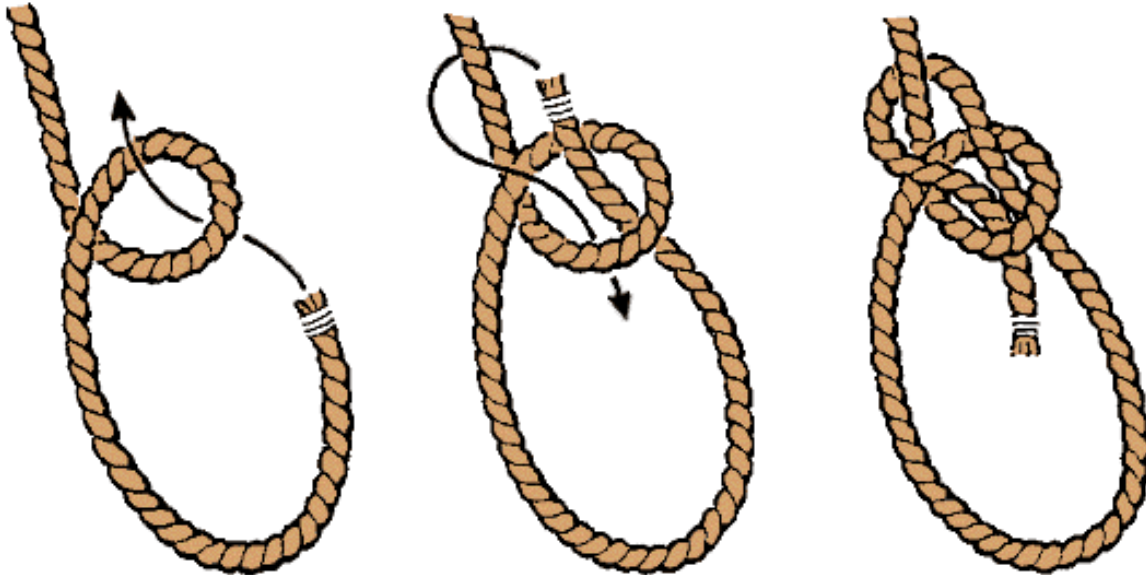
### Step 4: Place the balls in the bag.

Once you have created your balls out of your selected materials, you can then put them into your already created bag and secure it at the top with an elastic, rope or zip ties. It is crucial that the top be completely secure so that the bag does not open and let the balls escape. In the original design both zip ties and ropes were used for security.



**Step 5: Attach your rope.**

Your rope should be about five to six feet long so that it can be properly tied and give your P.E.T. room to float on the surface. Tie one end of the rope to the top of your bag, intertwining it through the mesh so that it stays secure. Attach the other end of your rope to the handles of your sustainable and rough material bag i.e. a burlap bag or a reusable grocery bag. This bag will act as one of the three layers of your anchor. It is recommended that users tie their rope with a bowline knot to ensure its secureness. See Diagram below.





**Step 6: Complete your anchor**

Place your sustainable bag, with the attached rope, into two pillowcases. This will act as extra support and protection. One end of the rope should then be inside the pillow case attached to the sustainable bag while the other is on the outside attached to your technology and mesh bag. Fill the pillowcases and sustainable bag with rocks then close it with larger zip ties or another rope. It is recommended that this step be completed at your launch site where you will be leaving your P.E.T. based on the heaviness of the rocks.



In these pictures we can see the effectiveness of using bright pillowcases and the larger, more durable zip-tie that closes the top of the pillowcase.

**Step 7: Mark your balls**

Use a luggage tag to identify your technology before putting it into the water. Write down your information and state that it is an ocean plastics monitoring device. Attach this tag to the bag of balls, so that it can be seen when floating.



## **The Protocol**

The P.E.T. can be used individually or by a group, the decision is up to the user. After constructing the technology, the user must then choose a location to deploy and place their P.E.T. We recommend a shallow body of water, with gentle current. When constructing the technology, the original design team tested out the automation in two different areas; on a shore line and in more open water. The results proved that plastics were more commonly found near the shoreline area. When the technology was placed in more open waters, the tides worked against its filtration method by constantly pulling it underwater, letting plastics in and out. It is recommended that the P.E.T. be put on a shoreline, in two to three feet of water. After double checking the rope's knots and the sealed anchor, the technology can then be placed into the water. Based on the chosen materials, the P.E.T. should float on the water's surface. Before leaving the technology users should make sure their tag has all of their information on it to avoid tampering and disruption. Users should also take note of where they are leaving their technology by taking a picture or choosing a landmark to remember. The device's time frame can be adapted by the user but it is recommended that it stay in for 5-7 days and be checked twice weekly to ensure it's secure and untampered. To take a sample the technology must be completely taken out of the water to ensure best results. The user should carefully pull their technology out of the water, keeping in mind plastics may be entangled in the outside mesh bag and may easily fall out back into the water. The P.E.T should then be placed in a garbage bag for transportation purposes, keeping the damp technology and its plastics contained. The device should be placed on a table with scissors to help with its disassembly, gloves for safety reasons and a jar to hold found plastics. Untie the bag and then begin the search for plastics amongst the bag and the balls themselves. Once all plastics are placed in a jar they can then be visually analyzed. It is recommended that users lay their found plastics out on graph paper to determine whether they are a macro plastic or a micro plastic. If there is difficulty determining a composition of plastic, users can then result to using a microscope or a magnifying glass. Users can then proceed to do as they please with their found plastics. It is recommended that users donate them to an ocean plastics monitoring research facility or group. If users reside in Eastern Canada, contact information includes, but is not limited to Dr. Max Liboiron at Memorial University of Newfoundland's Sociology Department.  
Email: mliboiron@mun.ca

## **P.E.T.: A Feminist Technology with Balls**

The P.E.T. is a technology which is feminist in design. Feminism is a complex, interdisciplinary, multilayered ideology. Brisolaro et al uphold that "there is no one unifying feminist theory" (2014, p.4). However, most forms of feminist thought (including the intellectual framework behind the P.E.T.) analyze and challenge various social issues and dynamics, that are shaped by various social positions which include, but are not limited to, gender, race, ethnicity, class, sexuality (Brisolaro et al, 2014). Essentially, feminism examines relations of power within society. These relations are impacted by elements of our social identity. In the case of the P.E.T. technology, the design process and technological artifact uphold certain feminist values. Throughout this process, we have drawn from various feminist theories, including: standpoint, critical, global and postcolonial, and queer theory. Accessibility was a major component of our technological design. This is displayed through various characteristics of our design process:

## **Open Access**

We have licenced the P.E.T. under a Creative Commons licence. The components of the Creative Commons, which have been carefully selected for the P.E.T., reflect feminist critical theory. Elements of our licence focus on overcoming “the existence of power, domination, and exploitation” (Brisolara et al, 2014, p.15). We have made strategic decisions, in an effort to contest potential sites of power and oppression. Two key components of our Creative Commons licence for the P.E.T. are attribution and non-commercialization. Attribution is an important characteristic of our project’s feminist framework. We believe credit should be given, where credit is due. In a sense, this licence protects us and our intellectual work. While anyone is free to utilize and build upon the P.E.T. and our intellectual framework behind the technology, sufficient attribution of the project will allow all parties involved to be rightfully acknowledged. The attribution will also allow future audiences of future work on the P.E.T. to have access to the original pilot project. We have also chosen to mark the P.E.T. as a non-commercial project to protect our technology from possible future commercial patents. The P.E.T. is meant to be as accessible to the population at large as possible. This technology is not a capitalist venture for individual parties to make money on. It is, however, a technology which seeks to engage citizens in marine plastics science, regardless of social location and socioeconomic position. This element of the licence will ensure the P.E.T. stays that way. It is because we believe the P.E.T. should be available to anyone who wishes to engage in marine plastic science, that we have chosen to make the P.E.T. a non-commercial technology. Essentially, the Creative Commons licence is a tool to help us protect both the designers and users.

## **DIY**

The P.E.T. is not distributed as a working, functional object; but rather, users of the technology will assemble the monitoring device themselves before using it to monitor plastics. This design element takes up global and postcolonial feminism by “examining the role of dominant discourse in shaping reality” (Brisolara et al, 2014, p.15). General social discourse upholds that assembling and creating both scientific research and technology are not tasks for the general population, but for elite, institutionally educated, predominantly white male professionals. We view these professionals as “experts”. Therefore, we as the general population tend to shy away from creating our own technology and use what is given to us by simply following instructions. Essentially, we are told how to be users. The DIY model attempts to dismantle that assumption by placing the task of assembling the technology on the user. Users will be able to see how the technology physically operates, which will expand their knowledge of the technology they are engaging with. Users are also encouraged to be resourceful when building their technology. Perhaps future users will have new, alternative materials ideas; or different, innovative ways to build the P.E.T. Furthermore, prospective builders of the P.E.T. may find alternative methods for building the technology which could potentially make the technology accessible to other social positions, which this pilot project has not addressed. The creators of the P.E.T. view these characteristic of the DIY model as “a problem posing, rather than problem-solving strategy for achieving equity in the information age” (Eubanks, 2011, p.104). Building the technology ourselves, allows us to realize our ability when social discourse tells us we are not capable. Through the DIY model, users become the expert. This means there is a shift from a passive user to an active user. In a sense, the user becomes the designer. This will allow users of the P.E.T. to overcome elitist scientific discourse by engaging in both the building and utilization of the technology.

## **Materials**

The materials chosen for the P.E.T. have come from relatively low-cost household objects. We decided to use common household materials that can easily be found, either around one's home or at a local department store, to keep materials reasonably priced and accessible. This allows for a wider range of potential geographical and social positioning among users (in a "western world" context). These decisions in the use of materials align with feminist standpoint theory. By keeping materials low in price (compared to general scientific research equipment) and commonly found in households or department stores, more people will be able to use our technology. This creates a cheaper alternative for the who are interested in scientific procedure and marine plastics research. Expensive scientific equipment no longer becomes a barrier for those who do not have the means to attain such equipment. Through selecting materials like kitchen scrubbies and loofas, people from various social situations (Brisolara et al, 2014, p.15) may begin to engage in marine plastics research. By allowing a greater volume of individuals (from various social locations) to engage in research, new insights and knowledge may be gleaned, for "different standpoints provide unique insights" (Brisolara et al, 2014, p.15). Essentially, the more diverse the collective studying a particular subject, the more robust our knowledge and insights may become. Relating this characteristic of our design back to the DIY model component of the P.E.T., once more people have access to the technology and information of marine plastics research, "it becomes clear that no one group of individuals [such as elitist scientists] has a monopoly on technological expertise" (Eubanks, 2011, p.132), or knowledge production.

## **Queering Possibilities**

Implicit in the P.E.T. design is the potential for queering scientific research and technology. Queer theory seeks to "raise awareness of heteronormative assumptions and the artificial nature of binary sex categories" (Brisolara et al, 2014, p.16). While this initial research project focused on producing a functional, workable technology; there are certain elements of queer theory which went into the aesthetic design of the P.E.T. The original design of the P.E.T. was a mesh sack with two balls to catch plastics. This was meant to resemble a male scrotum, in an effort to "disrupt... accepted understandings of what is considered 'normal'" (Brisolara et al, p.16, 2014). The aesthetic design of the P.E.T. was intended to disrupt heteronormative gender-binary concepts. In this context, any individual, regardless of gender identity, could potentially attain a functional "ball sack". This was conceptually conceived as a way to play with sex/gender boundaries and make science queer. While this report does not focus heavily on this queer design element, we strongly encourage others to explore and play with their balls in future endeavours.

## **Our Findings**

### **Initial Testing: The Bathtub Test**

In order to find the best balls to use in the P.E.T., some pre-deployment tests were conducted. Two team members at different locations conducted two separate bathroom tests. These bathtub tests were done using plastic pieces that had been collected around our homes, such as torn up grocery bags and cut up plastic bottles. We then added these to the water followed by the balls. Both tests lasted two days. The balls were made from the various meshes that we had decided would be best suited to use. The bathroom tests resulted in a four pieces of the plastic bottle and one piece of grocery bag being caught by the balls made out of steel wool

and those made of bathroom scrubber mesh. As a consequence of the results we found, these materials were used in the final production of the P.E.T.



### **Quidi Vidi Deployment**

The P.E.T. was deployed at a site very close to the opening leading out into the ocean from Quidi Vidi harbour on November 19<sup>th</sup>. The site was especially vulnerable to tidal changes, as well as very strong winds at times. In addition to the weather elements, the rocks around the area were very slippery making it difficult to stand on, however, the rocks did also serve as a landmark we could use to spot the P.E.T. We returned on November 20<sup>th</sup> to see if the P.E.T. had survived the night. It was still in place but it was submerged slightly deeper than before. We were able to find it using the vibrant purple pillowcase which supported the anchor. We retrieved the P.E.T. on November 23<sup>rd</sup> so it had been deployed for a total of five days. At this point it had moved further out than when we first deployed it and also much deeper into the water. Upon examining the contents of the bag and balls it did not catch any plastics of any size despite being made from our best available materials. Despite not having caught any plastics over this trial period, we were confident in the design of the P.E.T. and the longevity of the materials we used because the bag and balls did not fall apart. The five days of deployment also showed that the bag and its anchor were prone to moving with the elements. The anchor did work as it kept the bag on the floor even when the tide rose. It was useful in keeping the bag from drifting too far out for us to retrieve as well.

### **Topsail Beach Deployment**

After an inconclusive deployment at Quidi Vidi, it was determined that a change of location might prove to be more successful. We deployed on November 26<sup>th</sup> in the barachois (a coastal lagoon separated from the ocean by a piece of land) at Topsail beach. This seemed to be a perfect location, as it did not have the strong currents and tidal changes that were associated with the Quidi Vidi site. We retrieved the P.E.T. on the 29<sup>th</sup> of November. It was still in the original location, floating above the surface and held in place by the anchor! Ideally, we would have kept the technology in the water for at least five days, but due to time constraints, we resulted to shortening the time period. This trial proved more successful, as the bag had managed to catch

some form of plastic. There was a strip of clear plastic lodged in the mesh sack. The balls proved to function well, even though what they caught might not necessarily be considered plastic. There were three small pieces of biological matter found lodged in the balls themselves.



### **Summary of Findings**

We determined that the bag and balls that make up the P.E.T. are capable of catching ocean plastics as we found on the Topsail Beach trial. The P.E.T. also catches other small objects that are not plastics.

Despite the success, it was also discovered that the P.E.T. does have limitations. These limitations were displayed on the Quidi Vidi trials. Firstly, the location of deployment is important as the P.E.T. is vulnerable to sinking in areas with rising tides. The anchor will keep the bag and balls rooted so they will definitely become submerged should the tide rise. Secondly, the P.E.T. is likely to move from its original position if it is deployed in an area with strong current. The movement is gradual thanks to the anchor, but on trials where the P.E.T. is left out for a long period of time, it could become impossible to retrieve if it has moved too far out. The third limitation is that we can only use it close to the shoreline in order to retrieve it. It is not possible to deploy P.E.T. without an anchor, as it will float away which means that we cannot look for plastics in deeper water. The technology is limited to monitoring plastics on the surface of waters.

Due to these limitations, we could not determine whether or not there are any plastics in the Quidi Vidi area since we did not actually catch any. However, we are able to confirm that there are plastics in the barachois at Topsail Beach area. Our P.E.T. can be used to collect samples of plastics provided it is deployed in a location where the water is shallow enough to allow for anchoring without submerging the bag and balls and also close to the shore so it can be easily retrieved. Further research is required to analyze the longevity and durability of the P.E.T.

## **Future Possibilities**

Acknowledging we can not account for all social locations within the design of one artifact, we had originally envisioned a workshop based building exercise which would be open to the public. Unfortunately, due to time constraints, the workshop was not a feasible venture at this time. However, we would like to share our thoughts and ideas with you, in the hope that the workshop component of the P.E.T. project may come to fruition in the future. Ideally, the location of the workshop should be accessible by all modes of transportation, taking into account issues such as public transit routes and wheelchair access. For the workshop, we would begin by demonstrating the P.E.T. as it functions now by using a marine plastics “touch tank”; a portable clear tub which contains water, sand and marine plastics that the P.E.T. has already caught. The group would then be able to ask questions and share insights which may be useful to other builders. We would then build our P.E.T.’s together, being able to make our own decisions on the final product.

The end result may be that everyone’s technology is different, and that’s okay. For some individuals, their P.E.T. may no longer resemble a ball sack, as a sack may not be suitable for all users. The job of the facilitators of the workshop, would be to provide context and education on the issue at hand, so that users may design a technology that fits their needs. This approach borrows from two feminist theories: standpoint feminism and queer feminism. Standpoint theory upholds that individual situations are unique and may offer the group new, valuable insights (Brisolara et al, 2014, p.15) when hacking their P.E.T. This framework accounts for multiple situations and posits that instead of pushing the “other” (one who does not share your situations) to the side, we should embrace their experience for they may enlighten our understanding of the world. Queer feminism comes into play when we look at the final products which may be produced. By hacking the technology and playing with gendered terms, we are implying that a P.E.T., which resembles testes, may not be for everyone. This is another tool we can employ to raise awareness surrounding hetero-normativity and “artificial nature” of gender binaries (Brisolara et al, 2014, p.16). Some may have no balls, some may have two, and some may have ten. Balls may not be for everyone, but the size of your balls does not effect your ability to engage in critical, thoughtful scientific work.

## Works Cited

Barnes, D., Galgani, F., Thompson, R., & Barlaz, M. (2009). Accumulation and fragmentation of plastic debris in global environments. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 1985-1998. doi:10.1098/rstb.2008.0205

Brisolara, S., Seigart, D., & SenGupta, S. (Eds.). (2014). *Feminist evaluation and research : Theory and practice*. Retrieved from: <http://oneseach.library.mun.ca/01MUN:Everything:Alma-MUN51381326770002511>

Derraik, J. (2002). The pollution of the marine environment by plastic debris: A review. *Marine Pollution Bulletin*, 842-852.

Eubanks, V. (2011). *Digital dead end : Fighting for social justice in the information age*. Cambridge, Mass.: MIT Press.

Winner, L. (1980). Do Artifacts Have Politics? *Daedalus*, 109(1), 121-136.



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