

# Who is greener? ---Comparing plastic bags with paper bags

2018-19 M5X01238 Design for Manufacture

Muchun Guo  
MDes | BA | BSc Product Design

Recently, a piece of news attracted my attention: Even one of the most remote places on Earth couldn't hide from the scourge of plastic trash. Plastic bags were found in the deepest trenches. The new study is just one example of plastic pollution that has spread all over the world.

(National Geographic, 2018) Meanwhile, according to an article in the Guardian in January 2019, Morrisons supermarkets began using paper bags as shopping bags at higher prices than plastic bags. (see figure1) Morrisons officials said this is because paper bags are greener than plastic bags. (The Guardian, 2019)



Figure1 (Source: The Guardian)

This has given me greater interest in these two bags. Is the paper bag really greener than the plastic base? Through this report, I will get a more objective evaluation of the two bags by comparing plastic bags with paper bags in terms of materials, production, frequency of use, recycling, and so on.

First of all, I use the form of questionnaire to understand the using, purchasing, recycling, perception of plastic bags and paper bags. Thirty six interviewees, all of whom were selected from different age groups, were selected for the survey. These pictures (see figure2) are the questions of the questionnaire and the statistical charts based on the results.

## Questionnaire for plastic bags and paper bags

NO. \_\_\_\_\_ GENDER \_\_\_\_\_ AGE \_\_\_\_\_

- 1) How often do you use **plastic bags** a week?  
A. once a week(less) B. 2-4times a week  
C. 5-7times a week D. more than 8 times a week
- 2) How often do you use **paper bags** a week?  
A. once a week(less) B. 2-4times a week  
C. 5-7times a week D. more than 8 times a week
- 3) Where do you mainly use **plastic bags**? (multiple choices)  
A. supermarket B. market C. shopping center D. work/study  
E. other \_\_\_\_\_
- 4) Where do you mainly use **paper bags**? (multiple choices)  
A. supermarket B. market C. shopping center D. work/study  
E. other \_\_\_\_\_
- 5) How many **plastic bags** do you buy in a week?  
A. 1-2 (or no) B. 3-4 C. 5-7 D. more than 7
- 6) How many **paper bags** do you buy in a week?  
A. 1-2 (or no) B. 3-4 C. 5-7 D. more than 7
- 7) Do you categorize **plastic bags** alone when you throw them away?  
A. yes B. no
- 8) Do you categorize **paper bags** alone when you throw them away?  
A. yes B. no
- 9) Which one do you think is greener for plastic bags or cloth bags?  
A. plastic bags B. paper bags

Figure2

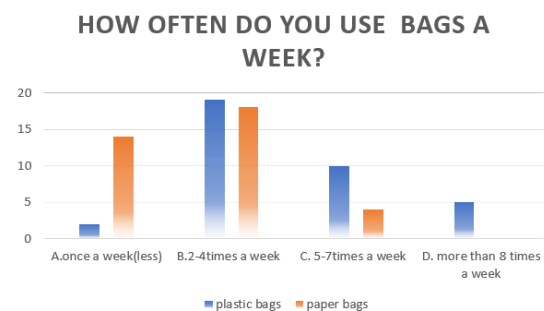


Figure3

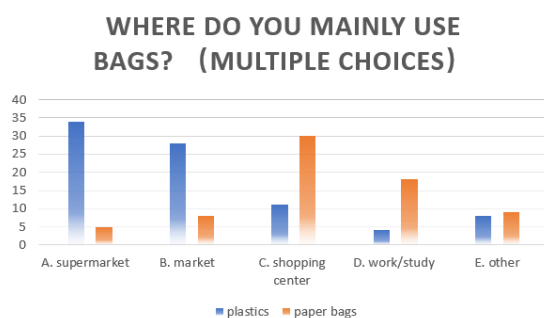


Figure4



Figure5

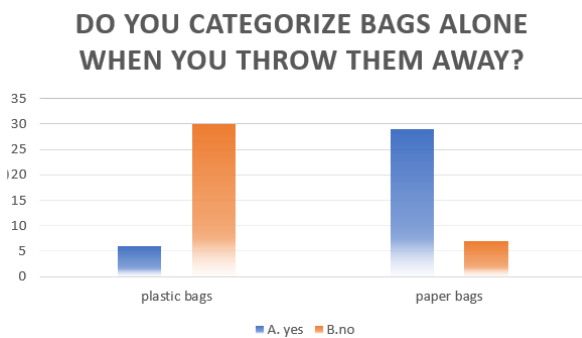


Figure6



Figure7

According to statistics, more than 40 percent of people use plastic bags five or more than five times a week, compared with about 10 percent for paper bags. People use plastic bags more frequently than paper bags. In the places where they are used, plastic bags are mainly used in supermarkets and markets, while paper bags are mainly used for shopping and job learning in shopping malls.

Nearly 90% of people don't buy or buy a small amount of paper bags in a week, while nearly 70% buy more than three plastic bags a week. Combined with previous data analysis (see figure4), there is a high demand for new plastic bags when people go to supermarkets and markets. However, nearly 80% of people do not have a separate classification of plastic bags when dealing with garbage. On the contrary, most people have a separate classification of paper bags.

The survey found that most people think that paper bags are more environmentally friendly. Because they think plastic bags take hundreds of years or even more to degrade, but paper bags can be recycled. But is the paper bag really greener?

As to whether a product is environmentally friendly, we can't just decide whether it can be degraded after it is discarded by people. If you compare the two kinds of bags from more perspective, the answer may be different. From the moment a product is produced, every link of it will have an impact on the environment until the product has been disposed of. This whole process is called the Product Life Cycle.

| INDICATOR OF ENVIRONMENTAL IMPACT             | Plastic bag<br>HDPE<br>lightweight | Paper bag |
|-----------------------------------------------|------------------------------------|-----------|
| Consumption of nonrenewable primary energy    | 1.0                                | 1.1       |
| Consumption of water                          | 1.0                                | 4.0       |
| Climate change (emission of greenhouse gases) | 1.0                                | 3.3       |
| Acid rain (atmospheric acidification)         | 1.0                                | 1.9       |
| Air quality (ground level ozone formation)    | 1.0                                | 1.3       |
| Eutrophication of water bodies                | 1.0                                | 14.0      |
| Solid waste production                        | 1.0                                | 2.7       |
| Risk of litter                                | 1.0                                | 0.2       |

Figure 8 (source: *Comparison of Environmental Impact of Plastic, Paper and Cloth Bags*, by Northern Ireland Assembly)

**Material:** Paper bags are made of pulp made from trees that have been dry for at least three years. Peel off the bark of the tree, cut bole into pieces, and make pulp under intense pressure and high heat. Then the pulp is washed, bleached, colored, and cut into the shape of a paper bag in the machine. (Schmoll) Of course, paper bags can also be made from paper product that are recycled. Although there is no need for cut-down trees to be used as raw materials, the process of recycling, cleaning, blanching and re-making pulp from waste paper will also produce a lot of dust and sewage. In addition, paper fibers can only be recycled five or seven times, and it's hard to know how many times recycled paper has been recycled before, and because recycled paper has shorter fibers, the paper quality is worse than the virgin paper. (Papernet, 2015) Many companies that pursue the good quality of paper bags will prefer to use virgin. In my survey, many people think that paper bags are greener because plastic bags are made from fossil fuels and are difficult to degrade by the land, and trees made into paper bags are renewable resources. But the book called *Design is the problem: the future of design must be sustainable* says that (see figure9) tree regeneration requires replanting plans and carefully managed conditions, and that its biodegradation only occurs when it is

put in the land, and other natural conditions are needed. (Shedroff, 2009.)

|      | Paper                                                                                                                                                        | Plastic                                                                                                                                                                                     |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pros | Made from a renewable resource (trees)<br>Biodegradable                                                                                                      | Much lighter than paper bag<br>Despite being made from fossil fuels, uses considerably less material and releases significantly less greenhouse gas in the manufacturing and transportation |
| Cons | Trees are renewable only if replanted and carefully managed<br>Biodegradable only if not put in a landfill (basically, nothing in a land fill ever degrades) | Made from fossil fuels                                                                                                                                                                      |

Figure 9 (Source: *Design is the problem: the future of design must be sustainable*)

**Waste and pollution of Water Resources:** Refer to the research data in Environment Agency (2011), production of a paper bag consumes four times as much water as a plastic bag, and the chemicals used to make paper contribute to acid rain and waterway eutrophication. When it comes to eutrophication, paper bags can cause 14 times as much pollution as plastic bags. And 50 times more water is wasted in the production of paper bags than in plastic bags. (Tompson)

**Air pollute:** Paper bags produce 80% more greenhouse gases than plastic bags. Because trees used to make paper could absorb a portion of carbon dioxide, the ratio may be slightly lower. (Mcgrath)

**Recycling:** Recycling a paper bag may require more fuel than making a new paper bag. Also, recycling a pound of paper wastes 91% more energy than recycling a pound of plastic. (Mcgrath)

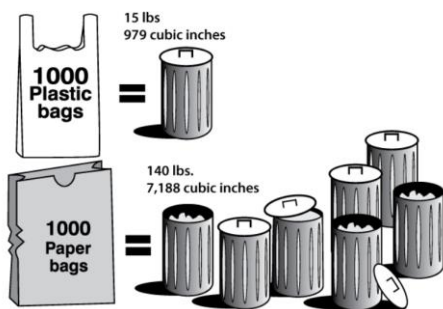


Figure 10 (Source: International plastics)

**Solid waste:** If all the plastic bags that people use in a year are replaced with paper bags, the amount of solid waste will increase by more than 100 million tons and occupy seven times the space of the landfill. (see figure 10) (International plastics)

| 1000 Grocery Size Shopping Bags |                                                                                     |                                                                                     |
|---------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                                 |  |  |
| Type                            | Paper                                                                               | Plastic                                                                             |
| Weight                          | 140 lbs.                                                                            | 15 lbs.                                                                             |
| Cubic Feet                      | 17.8 cu. feet                                                                       | 0.4 cu. feet                                                                        |
| Cost                            | \$230                                                                               | \$35                                                                                |
| Shipping                        | \$28                                                                                | \$3                                                                                 |
| Total Cost                      | \$258                                                                               | \$38                                                                                |
| Diesel used in transit          | 0.58 gallons                                                                        | 0.06 gallons                                                                        |
| Biodegradable?                  | yes                                                                                 | yes                                                                                 |
| Recyclable?                     | yes                                                                                 | yes                                                                                 |
| Air Emissions                   | 3.225 lbs. solids                                                                   | 1.62 lbs. solids                                                                    |
| Petroleum used                  | 3.67 lbs.                                                                           | 1.62 lbs.                                                                           |
| BTUs required                   | 1,629,000                                                                           | 649,000                                                                             |
| Indefinite recycled life?       | no                                                                                  | yes                                                                                 |
| USA raw materials?              | yes                                                                                 | yes                                                                                 |

Figure 11 (Source: International plastics)

**Transportation:** The weight and volume of a paper bag is larger than a plastic bag, which means that the same number of paper bags need to be transported more times and require more fuel such as oil. (Edgington) More specifically, 1000 small bags weigh 11 pounds, 1000 medium bags weigh 24 pounds, and 1000 large bags weigh 38.8 pounds. And 1000 paper bags weigh 140 pounds and are much larger than plastic bags. Stacks of 2000 paper bags are about 7 feet tall, while 2000 bags are about 7 inches tall. (Ecomerge)

**Easy to break:** Most paper bags are not waterproof. When the weather is bad, such as rain, the paper bag is wet and easy to break, which makes it impossible for people to use the bag again

However, it does not mean that plastic bags are good in every respect.

**Long-term degrading:** Plastic waste is one of the wastes that take a long time to degrade. The plastic bags we use take 10-1000 years to degrade in the landfills. (Leblanc)

**The impact on animals:** Plastic bags can also pose a threat to the lives of animals. There are over one million marine creatures, and other birds and animals die each year from plastic trash. (National Geographic) (see figure 12)



Figure12 (Source: National Geographic)

**The impact on the environment:** Plastic bags are very light and easy to fly everywhere in the

windy weather, and that has an impact on the environment everywhere. (see figure 13)



Figure13 (Source: WNCN)

Both plastic bags and paper bags will affect the environment, biology and other aspects in varying degrees. I think it's hard to decide which one is better when compare the two shopping bags. Reusing and recycling as much as possible is the key point.

Every plastic bag bought from a supermarket or market is used only an average of 12 minutes before it is disposed of as garbage. Shoppers use nearly 500 million plastic bags a year, which means an average of 150 plastic bags per shopper year. (Reuse this bag) These results are as frightening as the number of plastic bags people buy every week in my previous survey.

In 2007, San Francisco was the first city to ban plastic bags, requiring residents to pay an extra 10 cents for disposable plastic bags or recycled paper bags when checking out. Since 2010, this policy has had a great effect on governance. It effectively reduces the city's plastic waste by 72%. Similarly, in the UK, since October 2015, supermarkets have started charging five pence for per plastic bag. According to statistics, it reduced the use of 80% of British plastic bags. (Strand and Kerr)

Although plastic bag policies in different cities and countries have had a good impact on local plastic bag use, this may not be enough. The policy of charging plastic bags is designed to give individuals a sense of re-using shopping bags and buying less new ones. When I did the survey before, I found that many people now think that 5 pence shopping bags in British supermarkets are acceptable to them. Nearly 70 percent of interviewees said spending five pence on shopping bags was not enough for them to remember every time they brought a shopping bag.

In addition to the policy of charging plastic bags for shoppers, some countries also have policies for merchants, supermarkets and so on. For

example, Japan has a law stipulating that retail stores such as supermarkets, convenience stores and other retail stores that use more than 50 tons of packaging materials within a year have an obligation to set their own targets for cutting shopping bags and wrapping paper. And they should report to the government on annual cuts. The environment minister has the power to impose a fine of less than 500000 yen (nearly \$4168) on businesses found to have failed to do so if their names are to be announced. Many retail stores are offering plastic shopping bags with fee and encouraging customers to bring reusable shopping bags. (Environmental Economy)

Combined with interviews with interviewees during the previous survey, I also have some ideas.

For example, the price and quality of shopping bags can be increased appropriately. When people have to spend more money on shopping bags after shopping, they raise awareness of bringing their own shopping bags. If the bag quality is better, it can also improve the number of times people use the bag.

Supermarkets can also provide customized bags of services. For example, in a good quality bag can be printed or texted according to the customer's needs. Or they can provide special bags for festivals such as Valentine's Day, Mother's Day, and so on. When they have a bag of special significance, they are more willing to use.

After talking about it, I found that some people would like to keep a well-designed paper bag after buying luxury goods for daily work and study. Luxury stores can also offer a variety of shopping bag options, one of which is of good quality and higher price, branded LOGO, for people who wish to use it frequently in the future.



Figure14 (Source: the news minute)

Some paper bags now use different materials at key locations such as connections. However, this is not good for recycling. For example, this paper bag (see figure 14) uses a little

plastic. If you want to improve the quality of recycling, reduce the cost of recycling, product designers need to minimize the use of materials. (Mackenzie)

In short, in order to improve the sustainable development rate of shopping bags, not only do national cities promulgate policies, companies should also have more humane programs to encourage people to reuse shopping bags. At the same time, from the point of view of the designer and producer of shopping bags, we should consider the use of materials, recycling, reproduction and other aspects as far as possible, so as to improve the usage times and recovery rates of bags. From the point of view of government, people's awareness of environmental protection should be improved, the usage times of the same bag should be increased, and the consciousness of classification and recycling of bags should also be increased.

---

#### Bibliography

- National Geographic (2018) *Plastic Bag Found at the Bottom of World's Deepest Ocean Trench*  
Available at: <https://news.nationalgeographic.com/2018/05/plastic-bag-mariana-trench-pollution-science-spd/>  
(Accessed: 4th March 2019)

- The Guardian (2019) *Morrisons to trial paper bags for groceries and higher price for plastic bags*  
Available at: <https://www.theguardian.com/business/2019/jan/28/morrisons-to-trial-paper-bags-for-groceries-and-higher-price-for-plastic-bags>  
(Accessed: 4th March 2019)

- Northern Ireland Assembly (2011) *Comparison of Environmental Impact of Plastic, Paper and Cloth Bags*  
Available at: <http://www.niassembly.gov.uk/globalassets/documents/raise/publications/2011/environment/3611.pdf>  
(Accessed: 9th March 2019)

- Schmoll, N. *What Are Paper Bags Made Out Of?*  
Available at: [https://www.ehow.com/info\\_8203353\\_paper-bags-made-out.html](https://www.ehow.com/info_8203353_paper-bags-made-out.html)  
(Accessed: 9th March 2019)

- Papernet (2015) *Virgin vs recycled paper*  
Available at: <https://www.papernet.com/americas/usa/en/virgin-vs-recycled-paper>  
(Accessed: 9th March 2019)

- Environment Agency (2011) *Life cycle assessment of supermarket carrier bags: a review of the bags available in 2006*  
Available at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/291023/scho0711buan-e-e.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291023/scho0711buan-e-e.pdf)  
(Accessed: 10th March 2019)

- Tompson, C. (2017) *Paper, Plastic or Reusable?*  
Available at: <https://stanfordmag.org/contents/paper-plastic-or-reusable>  
(Accessed: 10th March 2019)

- McGrath, J. *Which is more environmentally friendly: paper or plastic?*  
Available at: <https://science.howstuffworks.com/environmental/green-science/paper-plastic1.htm>  
(Accessed: 10th March 2019)

- Shedroff, N. (2009) *Design is the problem: the future of design must be sustainable* Louis Rosenfeld

- International Plastics *Paper Bags VS: Plastic Bags - Real Numbers*  
Available at: <http://www.interplas.com/packaging-earth-friendly-recyclable-plastic-bags>  
(Accessed: 12nd March 2019)

- Edgington, T. (2019) *Plastic or paper: Which bag is greener?*  
Available at: <https://www.bbc.co.uk/news/business-47027792>  
(Accessed: 12nd March 2019)

- Ecomerge (2011) *THE WEIGHT OF PAPER AND PLASTIC*  
Available at: <http://ecomerge.blogspot.com/2011/02/weight-of-paper-and-plastic.html>  
(Accessed: 14th March 2019)

- Leblanc, N. (2018) *The Decomposition of Waste in Landfills: A Story of Time and Materials*  
Available at: <https://www.thebalancesmb.com/how-long-does-it-take-garbage-to-decompose-2878033>  
(Accessed: 14th March 2019)

- National Geographic (2016) *See How It Feels to Be an Ocean Animal Stuck in a Plastic Bag*  
Available at: <https://www.youtube.com/watch?v=vaDx-WJAsaE>  
(Accessed: 14th March 2019)

- Reuse this bag *Where are Plastic Bags Banned Around the World?*  
Available at: <https://www.reusethisbag.com/articles/where-are-plastic-bags-banned-around-the-world/>  
(Accessed: 14th March 2019)

- Strand, B. and Kerr, A. C. (2018) *10 Cities and Countries Confronting Plastic Bag Pollution Head-On*  
Available at: <https://www.earthday.org/2018/04/20/10-cities-and-countries-confronting-plastic-bag-pollution-head-on/>  
(Accessed: 14th March 2019)

- Mackenzie, D. (1997) *Green Design: Design for the environment* 2nd ED. By Laurence King Publishing