An Investigation into UBC's Mug Share Pilot Project

Aashish Karna, Courtney Collins, Lotus Fenn, Max Hollingworth, Mesbah Mowlavi

University of British Columbia

APSC 262

April 07, 2016

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Courtney Collins
Lotus Fenn
Max Hollingworth
Aashish Karna
Mesbah Mowlavi

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Instructor: Paul Winkelman

April 7th 2016

Abstract

The Mug Share program at the University of British Columbia (UBC) is currently in the early stages of a pilot project, and this paper aims to help guide the growth of the initiative through researching scientific literature to assess the life cycle analysis of several mug options, providing examples of similar projects in other cities, and to propose a solution to the issue of mug security. A survey was conducted to receive feedback from program participants in order to gauge the current status of the pilot project, and to guide the research conducted. A Triple Bottom Line (TBL) analysis compares disposable and reusable cups as it is important to determine if reusable cups are worth using, followed by a more in depth look at the recommended choice of reusable, stainless steel mugs. Several case studies of similar programs are then conducted to provide insight on how the UBC Mug Share pilot project may proceed and ultimately an electronic tracking system is suggested to tackle the issues of mug security.

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Glossary

Ferro: Includes iron.
Joule: A unit of energy.
Stainless Steel: A type of steel which contains chromium and nickel. Resistant to tarnishing or rust.
Polystyrene: A common type of plastic. Can be solid or foamed.
Virgin Production: Fabrication using materials from sources that have never been used or processed.

Abbreviations

app: application
AP : acidification potential
g: gram
GWP: global warming potential
GJ: Giga Joules
ID: identification
iOS: iPhone Operating System
kg: kilogram
kJ: kilo Joules
Oz: ounce
PS: polystyrene
UBC: University of British Columbia
UNBC: University of Northern British Columbia

1.0 Introduction

UBC's Mug Share pilot project is a collaboration between UBC Common Energy, an organization that seeks to promote sustainability around the campus, and the three participating cafes. Currently, Mug Share is operating out of Seedlings, Sprouts and Agora, three student run cafes staffed mainly by volunteers. Through Mug Share, the collaborators aim to provide UBC students and staff with a convenient, sustainable alternative to single use coffee cups and in doing so, reduce the amount of waste created by disposable cups.

In the current system, Mug Share participants pay a refundable five dollar deposit and receive a laminated membership card as seen in Figure 1. When the participant wishes to purchase a hot beverage in one of the reusable mugs they exchange their membership card for the mug and then when they return the mug, they receive back a membership card. Each mug has an ID number labeled with a sticker. When a mug is signed out, cafe staff record this number, the name of the person signing out the mug and the date on a paper spreadsheet which is later entered into a google docs spreadsheet. Returned mugs are washed and sterilized at the cafe before being used again.

Figure 1. - Mug Share membership card

The mugs currently in use are 14oz stainless steel mugs with a plastic, leak resistant lid. They were sourced from the University of Victoria and purchased at the cost of 11 dollars each.

2.0 Guiding Research - Survey Results

In coordination with the client, a survey was drafted and released to the current members of the Mug Share program in order to gauge participant involvement and to guide our research. All members were emailed a copy of the survey and were asked to voluntarily fill out the form, with approximately 50% of members participating. Since the overall success of the Mug Share program depends on the outcome of the initial pilot project, feedback from the current members provides important information on how the program should proceed.

As previously described in the introduction, the Mug Share program aims to find a sustainable alternative to single use coffee cups, thus reducing the amount of waste created by disposable cups. In the early stages of the pilot project, members of the Mug Share program have indicated that the reusable, stainless steel mugs provided has decreased their use of disposable cups as seen in Figure 2. However, if the program is to continue, it will be very important to determine if it is worthwhile to use reusable mugs. Many members indicate that they would like to participate next year as well; see Figure 3. If the number of participants are to grow, we must ensure that we have made the correct choice in using the reusable, stainless steel mugs. Reusable mugs require a great deal more resources and energy to be manufactured, as well as water use for washing. The above factors are not present in the disposable cup case and will be a leading area of our research.

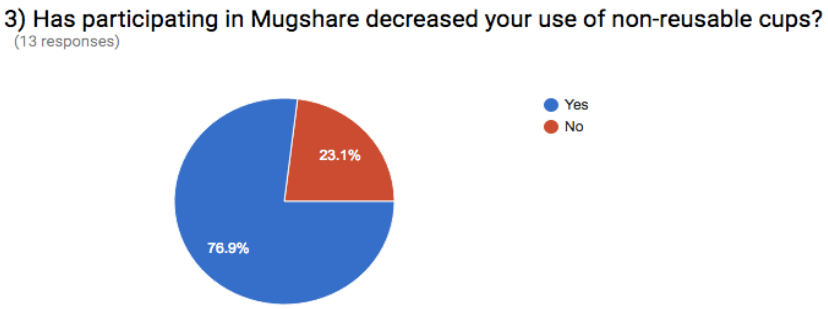

Figure 2. - Disposable cup use

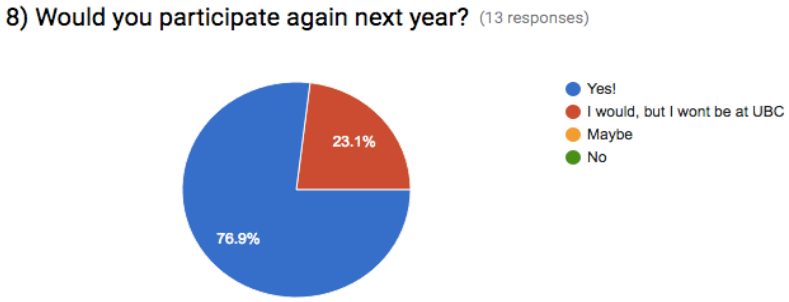

Figure 3. - Participation statistics

The University of British Columbia (UBC) Alma Mater Society (AMS) and UBC Food Services require a successful pilot project before they will consider expanding the project. Those currently using the program, have expressed a desire for the program to be expanded into areas of which the AMS and UBC Food Services control, such as the Nest and the Tim Hortons and Starbucks franchises on campus as seen in Figure 4. To help ensure initial success of the pilot program, several other programs from different cities and Universities were researched to try and assess their successes and downfalls. At this stage, it may be of interest to consider the city of Vancouver's desire to "cut down on the number of coffee cups, plastic bags and polystyrene food packaging that often end up in the city's litter." (CBC News, 2016) As that may be able to influence and drive the success of the pilot Mug Share project.

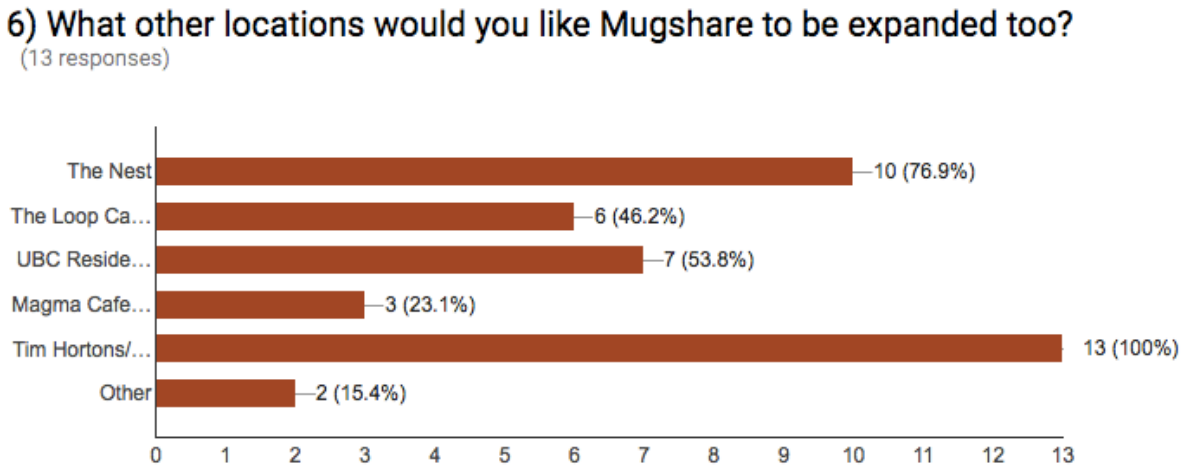

Figure 4. - Locations for expansion

Should the program succeed at UBC, with such a large student population, it may be conceivable that this program be shared with the city of Vancouver in an attempt to aid them in their efforts to reduce disposable cup waste and roll out the program into areas outside of the UBC campus. Mug choices, tracking systems, return policies and locations will all play crucial roles as the program expands within and potentially beyond campus. We have specifically considered the different mug choices and possible tracking system solutions. The current tracking system has proven to be a bit tedious, and only considered relatively easy by the majority of participants. The proposed tracking system and solutions are presented later in this paper.

3.0 Mug and Supplier Selection

3.1 Disposable Versus Reusable

Before searching for the ideal reusable mug, it is important to determine whether or not reusable mugs are even worth using. By common sense, it seems like a reusable mug is a more sustainable alternative to a disposable mug. However, that is not always the case. Producing a single reusable mug requires a lot more resources when compared to producing a single disposable cup. Each time a reusable mug is washed, water and energy is also used. It takes many uses of a reusable mug it becomes a better option than a disposable cup.

At the University of Victoria, a study by Hocking (1994) analyzed the energy costs of five different types of reusable and disposable cups (ceramic, heat-proof glass, reusable polystyrene, uncoated paper, and moulded polystyrene foam). For each cup, the energy used in its entire life cycle was considered. The life cycle includes raw material extraction, fabrication, use, and disposal. Below we will present part of Hocking's research.

Table 1 - Shows the energy required to make each type of cup (Hocking 1994)

Table 6. Energy required to make typical hot drink cups[a]

Cup type	Mass range (g)	Selected cup (g)	Energy requirement kJ/g (ref.)	Energy requirement kJ/cup
Ceramic	227–337	292.3	48.2 (van Eijk and others 1992)	14,088
Heat-proof glass	166–255	198.6	27.7 (Fenton 1992)	5,501
Reusable polystyrene	27–109	59.1	106.6 (Fenton 1992)	6,300
Uncoated paper	6.3–10.2	8.3	66.2 (Hocking 1991b)	549
Moulded PS foam	1.4–2.4	1.9	104.3 (Hocking 1991b)	198

[a]See Tables 1–5 for details of methods used to derive kJ/g figures quoted here.

As seen in table 1, the amount of energy required to make a single reusable cups is many times greater than the amount of energy required to produce a single disposable cup. Assuming that each reusable cup was washed after a single use, Hocking (1994) calculated the energy consumption per a use of a reusable cup as $(A+EB)/E$, where A is the energy cost to produce the cup, E is the number of uses before disposal, and B is the energy cost to wash the cup. With a large number of uses (large value of E), the

initial cost to produce a single cup becomes insignificant and main use of energy is from washing the cup. The cost to wash each cup used was 184 kJ, based on the average Canadian dishwasher. When assuming that a disposable cup is used only once before disposed, the energy per use is simply the cost to produce the cup.

However, Hocking's research did not consider the energy costs of stainless steel cups. Stainless steel is a very popular material, and UBC Mug Share currently uses stainless steel cups. UBC Mug Share actually plans to buy more stainless steel cups in the future. At Yale University, Jeremiah (2007) found that at current global operations, 53 GJ are expended to produce 1 metric ton of stainless steel. Assuming that an average stainless steel cup weighs 100 g, we estimate that it costs 5842 kJ to produce a stainless steel cup. (Calculations: 53 GJ * 907185 g/ton * 100 g/cup = 5842 kJ/cup)

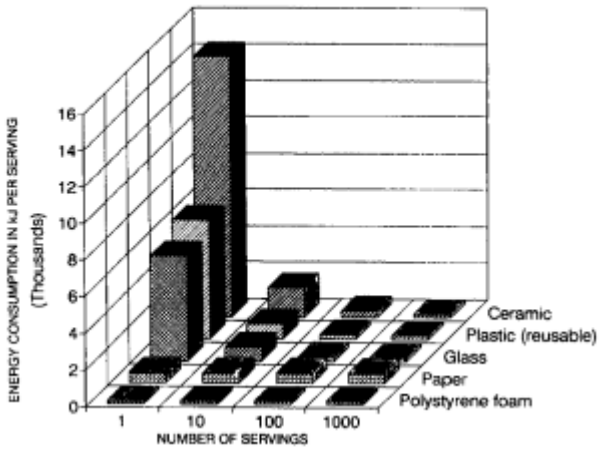

Figure 5. - The energy consumption per use based on the cup of type and number of uses (Hocking 1994)

As seen in figure 5, the energy cost per use of reusable cups is much greater than that of reusable cups with a small number of uses. However with a enough uses, the energy cost per a use of a reusable cup is eventually less than that of a disposable cup.

Table 2. - Shows the break-even points between reusable and disposable cups. The required return rate is $(break-even\ servings)/(break-even\ servings) * 100\,\%$ (Hocking 1994)

Cup pairs compared	Break-even servings	Required return rate (%)[d]
Glass/paper	15	93.8
Glass/PS foam	393	99.7
Plastic (reusable)/paper	17	94.4
Plastic (reusable)/PS foam	450	99.8
Ceramic/paper	39	97.5
Ceramic/PS foam	1006	99.9

Table 2 above shows the different break-even points of different reusable cups compared with paper and foam disposable cups, shown by Hocking (1994). The break-even point is the number of times a reusable cup must be used before it has the same energy cost per use as its disposable counterpart. The return rate shown is the return rate of the reusable cups required to break even. The break-even point for steel cups was calculated. We calculated that the break-even point for stainless steel is 417 uses for steel/foam and 16 uses for steel/paper.

The data shown in section 3.1 suggests that with a couple hundred uses, from purely an energy perspective, a reusable cup can be more sustainable than a disposable cup. It is worth noting that a polystyrene foam cup also takes significantly less energy to produce than a paper cup if UBC Mug Share does not plan to continue the program. Since it takes so many uses of a reusable cup for it to become worth using over a disposable cup, it is very important that UBC Mug Share uses a durable cup. Therefore we suggesting using stainless steel as opposed to ceramic or plastic.

3.2 Stainless Steel

Stainless steel emerged as top choice for the reusable mug to be used for the Mug Share Program. When compared to other types of reusable mugs such as ceramics and plastics, stainless steel had the edge in terms of higher durability and better resistant to corrosion and contamination. In addition to this, stainless steel is 100% recyclable Using research and life cycle analysis conducted by professionals, a Triple Bottom Line assessment was conducted on stainless steel for mugs.

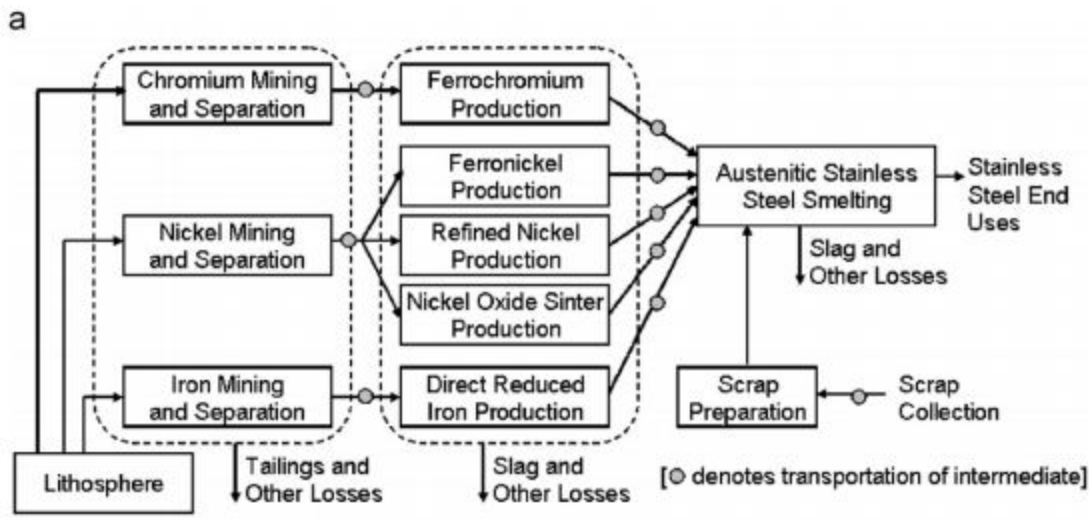

Figure 6: Stainless Steel Life Cycle (Johnson, Reck, Wang & Graedel, 2007)

3.2.1 Environmental Impacts:

When considering the environmental impacts of stainless steel, the entire production cycle was taken into consideration. The production cycle of stainless steel involves extraction of the mineral ores, purification and preparation of minerals and manufacturing of stainless steel at factories (ISSF, 2015). At each stage of the production cycle, emissions are produced, which are taken into account. Figure 6 shows a brief outline of the production process.

Table 3: Total emissions from production of stainless steel (ISSF, 2015)

Emissions from raw materials (ton CO_2 /ton stainless steel)	1.92
Emissions from electricity and steam (ton CO_2 /ton stainless steel)	0.54
Direct emissions (ton CO_2 /ton stainless steel)	0.44
Total CO2 emissions (ton CO_2 /ton stainless steel)	2.90

The table above highlights the amount CO_2 emissions in the production of stainless steel. CO_2 emissions from raw materials includes emissions from extraction of ores and the production processes of chromium, nickel and carbon steel scrap. The electricity utilized for mining and producing other ferro-alloys is also included. Direct Production Emission includes CO_2 emissions from the use of fuel as well.

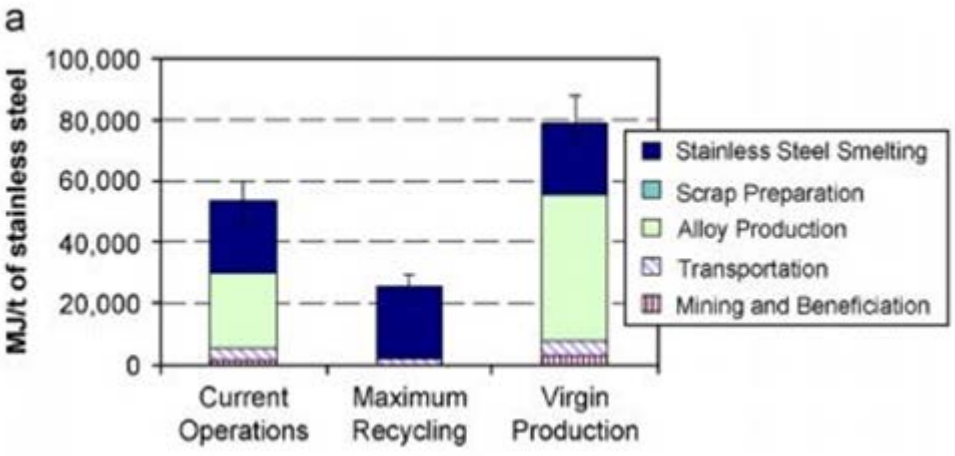

Figure 7: Energy use in production of stainless steel (Johnson et al, 2007)

Figure 7 shows the energy required to produce 1 tonne of stainless steel in three different scenarios respectively: Stainless steel produced at current recycling rates, stainless steel produced at maximum recycling and stainless steel produced without recycling. As seen in the graph, the energy required to produce 1 tonne of stainless steel at the current rate of recycling is quite high (about 53 GJ). One of the reasons is due to the fact that not all of the stainless steel available can be recycled immediately. The need for stainless steel is greater than the scrap available, therefore there is only partial recycling, the rest is made from raw materials. Theoretically, if we could achieve maximum recycling, the energy required to produce 1 tonne of stainless steel could drop as low as 26 GJ which is approximately half the energy currently. (Johnson et al, 2007)

Table 4: A breakdown of the production of stainless steel. Values under feedstock show energy needed and emissions generated for producing the raw materials. Values under 304 Stainless Steel show energy needed and emissions generated for producing the final stainless steel. (Norgate, Jahanshahi & Rankin, 2004)

Environmental impact	**Feedstock materials for stainless steel production**				**304 Stainless steel**	
	Iron	Nickel	Ferrochrome	Ferronickel	From nickel	from ferronickel
Total energy (MJ/kg)	22	114	56	110	49	75
Gaseous emissions						
CO2 (kg/kg)	2.0	11.1	5.1	8.9	4.8	6.6
CO (g/kg)	1.9	2.9	5.4	5.6	3.4	4.7
N2O (g/kg)	0.02	0.05	0.06	0.07	0.04	0.06
CH4 (g/kg)	2.6	46.6	6.2	18.4	6.0	10.8
NOx (g/kg)	12.6	44.6	29.6	70.6	24.8	44.1
NMVOC ** (g/kg)	0.20	2.70	0.17	1.60	0.40	0.80
SO2 (kg/kg)	0.007	0.107	0.018	0.026	0.022	0.020
GWP (kg CO2e/kg)	2.1	11.4	5.3	9.3	4.9	6.8
AP (kg SO2e/kg)	0.015	0.138	0.039	0.075	0.039	0.051

***NMVOC: Non-Methane Volatile Organic Compounds*

A much more detailed breakdown of the energy use and emissions in the production of stainless steel is shown in Table X.Y. This table also shows the difference in amount of emissions when different raw materials are used. It is proven that using pure nickel metal and iron metal as a source for the nickel alloy

in the production of stainless steel requires lower energy and has lower emissions than production using ferronickel. This is because the iron in ferronickel has a higher energy intensity, thus more energy is required to produce the same amount of iron as pig iron. (Norgate, Jahanshahi & Rankin, 2004)

Stainless steel as a material is 100% recyclable (ISSF, 2015), therefore mugs that have been deemed unusable can be sent to the recycling plant as scrap metal to be recycled and make stainless steel for new mugs or for other purposes. This would not only drive down the energy needed to make more stainless steel, but also the total emissions generated, thereby making it more sustainable.

3.2.2 Social Impacts:

Stainless steel mugs have had a positive response in terms of the social implications that were considered when choosing the suitable mugs. Stainless steel is resistant to corrosion and stains. (Hong & Koo, 2005; ISSF, 2015) This is due to the presence of chromium and nickel alloys (Hong & Koo, 2005) which provide the resistance that regular carbon steel lacks. These properties help give the stainless steel mugs its long lifespan, and prevent any chemical reactions with the beverages which could potentially be harmful to the users.

In addition to being stain and corrosion resistant, stainless steel is also easy to clean, making it a suitable choice for the mugs. The stainless steel mugs that were chosen are also dishwasher safe (Steelys Drinkware), which means the staff at the café do not have to manually clean each mug that is returned. With regard to usage, the mugs are well insulated and can hold any beverage, hot or cold. Furthermore, stainless steel is also impact resistant (ISSF, 2015), which means it will not break and shatter when exposed to a strong force. This, combined with the fact that stainless steel is very lightweight and portable, gives it an edge over ceramics and glass mugs amongst the users.

3.2.3 Economic Impacts

The cost regarding the purchase of the stainless steel mugs from Steelys Drinkware are as follows:

Table 5: Wholesale Mug costs (Steelys Drinkware, 2013)

Quantity	Price (USD)
48	11.99
72	10.99
144	9.99
1000+	9.99

Since the mugs are dishwasher safe, they will be cleaned and maintained by the dishwasher. The dishwasher has its own operating costs, which are to be incorporated with the total costs.

The dishwasher that is currently in use by the cafes has specifications as shown below

Table 6: Approximate dishwasher operating costs. Certain values taken from Hobart Corp (www.hobartcorp.com)

Water /wash cycle	0.74 gallons
Time/wash cycle	57s
Water /hour	46.62 gallons
Glasses washed /hour	2610
Heating from gas	25000 BTU
Electric heating	5 kW
Total Energy/hour	44.37 MJ
Average Energy per mug	17 kJ
Average Water per mug	0.0163 gallons

Recycling the mugs also has its own costs. Costs can vary depending on the location and the company chosen for recycling. Charges are approximately in the range of $0.35 - $0.55 per pound of stainless steel scrap. Since the stainless steel mugs are highly durable, they have a long life span (ISSF, 2005; Johnson et al, 2008) and thus recycling will not be necessary very often.

In the case of a lost/stolen mug, we would assume the mug is either put to good use or is recycled eventually, however, the café would need to generate the extra cost needed for a replacement mug as the deposits currently do not cover the entire cost of the mug. Ideally, there would be extra mugs in the store in terms unused stock, but the café would like for most of the mugs to be out in service.

4.0 Research into Other Mug Share Projects

In looking into how UBC's Mug Share might be improved an investigation was conducted into how similar projects in different cities or on different campuses were operating. Presented below are three examples of Mug Share initiatives and one of a to-go container program. Each example has a particular strength that UBC's Mug Share program could learn from.

4.1 Borrow-A-Mug

Borrow-a-Mug is a student run initiative that seeks to reduce disposable cup use at the on-campus Tim Hortons at the University of Northern British Columbia (UNBC) in Prince George (University of Northern British Columbia, 2015). The project started in 2012 and at the time, donated reusable coffee mugs were placed outside of the Tim Horton's for students and staff to borrow. Last year Borrow-A-Mug was able to upgrade to a set of matching and branded coffee that the organizers felt would appeal to a wider range of clients. Borrowed mugs are returned to various return bins located around campus then collected and washed by volunteers. This concept of creating a recognizable and attractive brand for their initiative could also be applied to UBC's Mug Share. For Mug Share to expand to new locations and attract more students, it will be important to create a brand for the project.

4.2 Robbinson Tiling Wall Mugs

The Robbinson Tilling Wall Mugs or the Community mug wall is a functional piece of artwork created in 2009 by Ryan Nussbacher, a student at Emily Carr University (Connect - Emily Carr University, 2009). Similar to the Borrow-A-Mug project, students and staff take a cup off the wall and take it to a café to be filled then return it to one of the return bins located around campus (Emily Carr Students Union, 2016), where it is then collected and washed by student volunteers. Both the Emily Carr and the UNBC Mug

Share programs provide their users with multiple drop-off locations to make returning the mugs easier for the participants. UBC is a much larger campus than either UNBC or Emily Carr and as such implementing return boxes at locations other than the cafes would be more logistically challenging but this concept would make returning the mugs much easier for users.

4.3 Go Box

Go Box is a reusable to-go box program that started in Portland and has since expanded to San Francisco (Go Box, 2016). In Portland there are over 80 participating street vendors and restaurants and over 2500 members. To become a member, the customer downloads the Go Box app and pays the $18 yearly membership fee then can use the service as many times as they like without having to pay a deposit for each individual to-go box. Return locations. Or “drop boxes” are scattered throughout the downtown area and are emptied daily and taken to an industrial kitchen to be washed. The Go Box app and the website provide the user with information on where they can find the nearest drop box or participating restaurant.

4.4 Good-to-Go

The Good-to-Go Mug Share pilot project was a student run project organized by students at the DO School and operated out of the Brooklyn Roasting Company in New York City (Malito, Alessandra, 2014). They piloted the project for three days in April of 2014 but have not continued with the program since (Yilmaz Akkoyun, Do School Partnership Development Manager, Email communication, March 4th 2016). In their model, participants paid a five dollar deposit for a plastic reusable mug then, when finished their beverage, returned the mug either to the café or to a return station. The participant would keep the cup lid as proof of membership the next time they went to the café. A cup return station was placed in the train station with the aim of facilitating easy cup return. In an interview with CNBC, Katherin

Kirschenmann, the DO school's chief executive, stated that the aim of Good-to-Go was to "create a program that would allow its users to reduce waste from single use cups but [give] them the same convenience" (CNBC, 2014). Whether through well placed return locations or an efficient mug sign-out system, UBC's Mug Share program will need to find ways to be as user-friendly as possible.

5.0 Proposed Technical Solutions

As mentioned in section 1.0 above, the current Mug Share uses laminated membership cards and a manual spreadsheet to keep track mugs that are currently signed out, and withhold the deposit of member who fail to return their mugs. The advent of the expansion of this project brings the need for a more efficient system of logging mug traffic. Therefore, we propose a three-phase digital mug-tracking system, which will expand and develop as the program gains users, and serves as a blueprint for future possible Mug Share expansions outside of UBC.

5.1 Website and Online Database

One of the flaws of the current system is the tedium associated with manually entering all taken mugs into a global spreadsheet. The first phase of the proposed mug-tracking system is an online database that would store entries corresponding to the member with the mug's number. This system would be comprised of two parts: a web-based front-end, which the cafe staff will interact with, and a server back-end to receive and store data. The front-end of the system will require a small tablet to be used by staff at each cafe. In keeping with the spirit of the Mug Share program, we recommend used tablets; the processing requirement of the system will be minimal, so older, lower-power tablets would be sufficient. The back-end is also simple and small enough to be hosted at minimum charge externally or even locally at UBC (we recommend contacting UBC IT services to discuss hosting options).

This web-based tracking system will not only reduce the difficulty of synchronizing paper spreadsheets kept at each cafe with an global version daily, but will also make keeping track of lost mugs much easier. The back-end can be customized to quickly identify overdue mugs, and additional features, such as email reminders to return the mug, can also be easily added to the system. A tablet-based front-end also

eliminates the need for the cafe to have any existing technology in place, and its small size-factor makes it a non-invasive addition to the space.

Development of this entire system, although non-trivial, would still be able to be completed by local UBC talent, with particularly good options within the 3rd to 4th year Computer Engineering and Computer Science student body. The purchasing of a used tablet can cost between 50 to 100 dollars, with one tablet required per cafe. In addition, a tablet stand may be required, adding an additional 25 to 50 dollars to each tablet. With the current three cafes participating in the Mug Share, the total cost of this implementation is approximated to cost around 350 dollars (which may vary depending on the cost of used tablets purchased), provided that UBC IT Services can provide the minor hosting requirement for free. If not, an additional cost of up to 5 dollars per month for website and database hosting should be considered.

5.2 UBC Card Scanner

While automating the system of tracking the mugs, the previous solution still requires the use of a membership card or login from the user. As an extension to the previous system, a magnetic card scanner can be attached via USB cable to the tablets, allowing UBC faculty and students to simply swipe their UBC Card to be authenticated. Members not part of the UBC community can still use their laminated membership cards or an email-pin login combination. An individual's ID number and name can be retrieved from a single swipe of the UBC Card, although consultation with higher-up authorities, such as the AMS, is recommended. The cost of a magnetic card scanner can, once again, range between 50 to 100 dollars, with several suitable solutions at the 65 dollar price point (Newegg, 2016).

5.3 Mobile Application

To further the ease of use of the system, and to account for a growing number of users, we propose a third expansion phase to the tracking system: a mobile application. This application would serve as the member identification, and would also extend the use of the system beyond just those with a UBC Card. A mobile application would also allow for the digital processing of the deposit, making it easier for new participants to sign up for the program. A mobile app would also serve as marking material, and development of a unifying brand and theme across print material, mug design and app design is strongly recommended.

A mobile app can also facilitate additional features, such as notification of overdue mugs, maps of closest return points, and could even enable reward-systems in cooperation with cafes (such as a discount after a certain number of mug borrows).

It should be noted that the cost of professionally developing such a solution may be within the thousands of dollars, hence it's inclusion as a final stage in the evolution of the mug-tracking platform. The development of a mobile app would most likely require a higher-skilled, small group of developers, who would be able to expand on the previous two phases' system, and integrate them with a new mobile app. To ensure adequate user coverage, the app should be designed for at least Android and iOS. Possible considerations for staying within UBC for development could be the 4th year Engineering Capstones project.

6.0 Recommendations

Since producing a single reusable cup requires many uses for it to become a more sustainable option than a disposable cup, we recommend UBC Mug Share use a very durable reusable mug. Specifically, we recommend using a stainless steel mug. Currently, the mugs that are in use were obtained from the University of Victoria (UVIC) at a cost of 11 dollars each. The mugs are manufactured by Steelys Drinkware, which manufacture a wide array of stainless steel drinkware products and we believe that it will be in the Mug Share's best interest to continue to use Steelys Drinkware as their supplier. Steelys Drinkware products are designed to be Zero Waste: "to stay out of the waste stream, [...] be passed on to others, or fully recycled at the end of their useful life." (http://steelysdrinkware.com) They also offer discounts for bulk orders, as well as the opportunity for custom imprinting if the Mug Share decides implement unique branding.

It is important for UBC Mug Share to keep track of the return rate on mugs. A poor return rate would create surmounting costs, cause the system to run at high losses, and severely undermine the ability of the project to stay viable against disposable cups. Thus, the small investment into the digital tracking system proposed above will significantly help increase the success rate of the project by providing a synchronized database of all currently outstanding mugs, and improving the usability of the system. We recommend an immediate implementation of phase one of the tracking system (as outlined in section 5.1), along with consideration of future integration of phase two and three as the membership of the Mug Share increases. This gradual approach will, at each stage, provide a tracking solution appropriate to the number of participants in the program, and substantially increase the usability of the system.

Another way to address usability issues may be to introduce bins located on populated areas of campus where the mugs can be dropped off at the user's convenience and before or after cafe hours. However, this will likely require more manpower to be supplied by the cafes so that the mugs can be recovered from the

bins, as well as introduce another security risk. A bin may also need to be designed for ease of drop off, without the ability to retrieve the mug, much like a post box. It will also need to consider a way to preserve the lifetime of the mug as repeated contact with other mugs from being dropped will significantly wear down the mugs.

Further research would need to be conducted into the best design and location for these boxes to maximize their effectiveness at increasing the sustainability and convenience of Mug Share.

Overall, with consideration to social, environmental and economic factors, Mug Share has the potential to decrease waste from single use cups on the UBC campus, and potentially serve as a model for future projects elsewhere.

7.0 References

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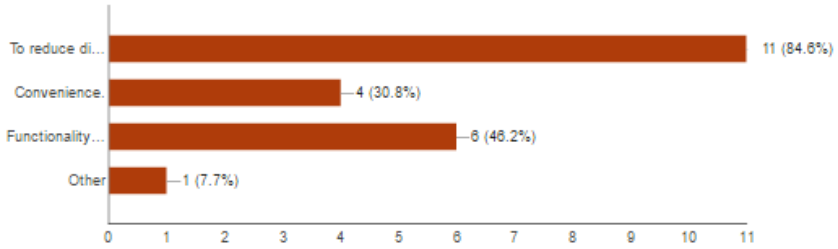
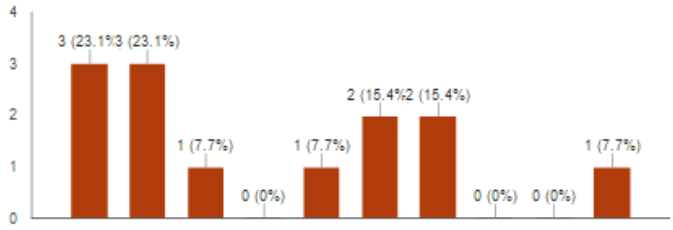
Appendix A - Complete Participant Survey Results

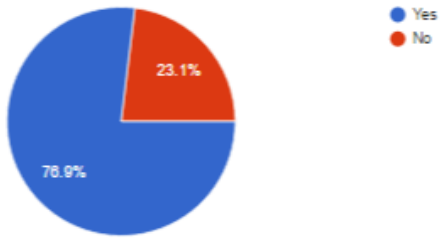
1) What motivated you to join Mugshare? (Select all that apply) (13 responses)



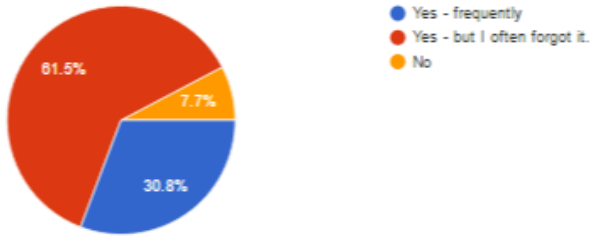
2) About how many times have you checked out/returned a Mugshare mug since joining?
(13 responses)



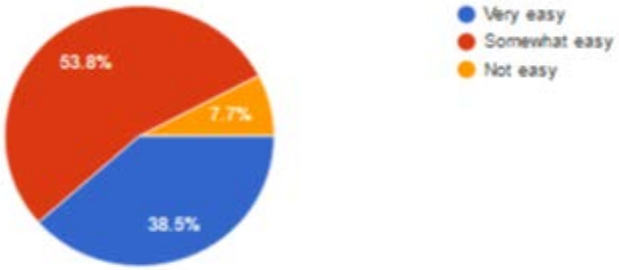
3) Has participating in Mugshare decreased your use of non-reusable cups?
(13 responses)



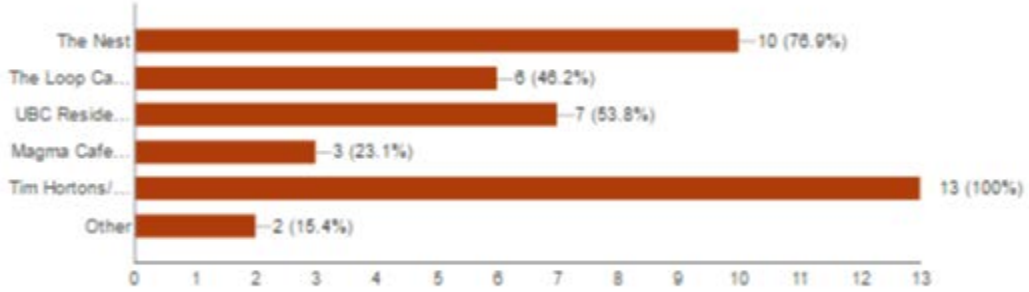
4) Did you bring a reusable mug to school before joining Mugshare?
(13 responses)



5) How easy have you found the process of exchanging the mug and membership card?
(13 responses)



6) What other locations would you like Mugshare to be expanded too?
(13 responses)



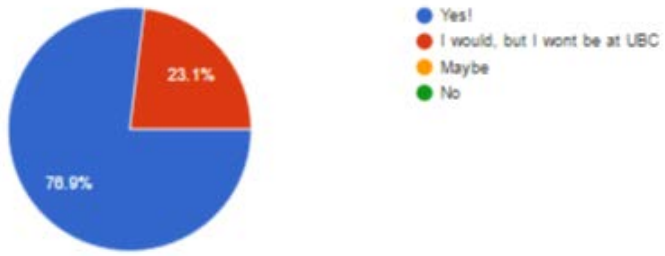
7) What do you think about the size of the mugs? (they are currently 14oz)
(13 responses)

Any other Feedback on the mugs? (lids, appearance, etc.) (9 responses)

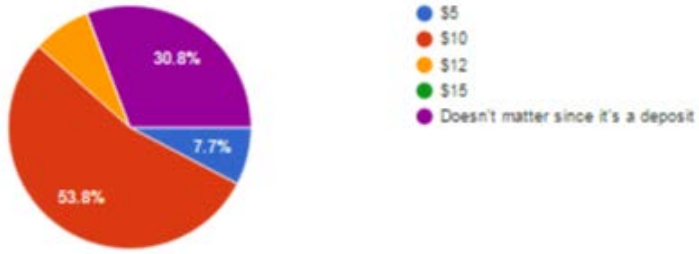
Any other Feedback on the mugs? (lids, appearance, etc.) (9 responses)

Mugs cannot keep coffee warm enough. There's no contact information on membership card, and there's not policy on loosing mug.
Looks great!
A bit too heavy
The spout is hard to drink from
I wonder if there could be a way to do it with a bunch of scone hand thrift store ceramic mugs as well, so perhaps it could be done without the member card and there could just be drop off bins around campus. Apparently Emily Carr has something like this.
No need for the coating, it scratches off and doesn't look great
Amazing Drinkability, although I find i drink my beverage too quickly because of this.
They looked kind of worn out
beautiful!!

8) Would you participate again next year? (13 responses)



9) What would be the maximum deposit you would be willing to make in order to participate? (You get this back at the end of the term)
(13 responses)



10) Any suggestions on how we could make Mugshare better or easier to use?
(9 responses)

As I know, sprouts doesn't offer to-go mug, so most people there already taken their own mug. The program will be more influential if it is in, for example, uppercase or lowercase, because they use non- reusable mugs.
Making sure all of the volunteers at Agora are informed.
Have a variety of sizes of mugs
Establish a more permanent/ better constructed/ better poisition sign out sheet
make sure there is enough training for everyone- some people are confused when you bring the mug back!
Students in the different cafes to give them back/grab them need to know what the program is really about
Get rid of the deposit and cards. Use second hand mugs if the program is expanded. Expand to plates, tupperwares, and cutlery and have all the food vendors on campus pay what they would have spent on disposable packaging nto a fund to cover program costs.
GREAT INITIATIVE!!!!
Electronic tracking system linked to student card.