

Electronic Waste at Humboldt State University

Kyle Stammerjohn

Kate Beyer

Julian Cardenas

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Problem Background

Broad overview of electronic waste in America

Over the last few decades the electronics industry has revolutionized the world: electrical and electronic products have become a normal part of today's life around the planet. Without these products, modern life would not be possible in post-industrialized and industrializing (developing) countries. These products serve in such areas as medicine, mobility, education, health, food supply, communication, security, environmental protection and culture. Such appliances include many domestic devices like refrigerators, washing machines, mobile phones, personal computers, printers, toys and TVs. Americans currently own nearly 3 billion electronic products and as new products are purchased, obsolete products are stored or discarded at increasing rates. In 2005, the USEPA (United States Environmental Protection Agency) estimates that 26-37 million computers became obsolete. In addition to computers, large numbers of TVs, VCRs, cell phones, and monitors also became obsolete that an estimated 304 million electronic devices weighing between 1.9 and 2.2 million tons were removed from U.S. households (United States Environmental Protection Agency Office of Solid Waste and Emergency Response, 2008).

Obsolescence generally occurs in electronics when a technological device breaks or is replaced. Replacement usually only happens when a device no longer performs to a perceived standard. Unfortunately this standard is shaped by technological advance, aesthetic design, advertising, and other media; which can occur irrespective of real performance. According to

Consumer Electronics Association (CEA) estimates, about two-thirds of the electronic devices removed from service were still in working order. However, only about 15% of this material was recycled while the vast majority was disposed in landfills (United States Environmental Protection Agency Office of Solid Waste and Emergency Response, 2008). Electronic wastes contain toxic substances such as lead, mercury, cadmium, and lithium. These toxic materials can be released upon disposal, posing a threat to human health and the environment. Inconsistencies in worker safety and environmental protection mean potential liability concerns for those sending electronics to recycling facilities especially if these facilities are located in developing countries. However, electronic wastes also contain precious metals such as gold, silver, which offer opportunities for economically viable recycling. For example, precious metals contribute well over 70% of all value related to cell phones, calculators and printed circuit board scraps. In other items such as TV boards, and DVD players they still contribute about 40% of the value.

Electronic waste at Humboldt State University

As an educational institution, it is important that Humboldt State University provide curricula that addresses and includes access to state of the art electronic technology. This is true across subjects and includes the way the faculty and staff conduct daily business. As a result, Humboldt State generates a considerable amount of electronic waste.

Electronic waste definition: Electronic products reaching the end of their "useful life". These can include such items as computers, televisions, VCRs, DVD players, radios, fax machines and a number of other popular electronic devices (Cal Recycle).

Electronic waste from Humboldt State University is collected and re-appropriated by the Office of Sustainability, in connection with Plant Operations through third-party recycling firms.

Computer monitors (CRT and LCD); computer processing units; keyboards and other accessories including cables and compact discs; smaller waste items associated with electronics like printer ink cartridges, fluorescent lights (including compact fluorescent lights- CFLs) and fluorescent lamp ballasts, batteries and servers all reach the end of their use at Humboldt State University. It is generally known that these kinds of items and other products like “disposable” phones and their chargers should not be simply mixed into most waste streams. While there are options for proper disposal, these options are underutilized, often unknown, and there is generally no incentive for proper electronic waste reappropriation.

The majority of electronic waste generated by Humboldt State University is collected from computer lab and faculty and staff office modernization processed over the summer, as well as periodic drives conducted on campus at various times of the school year and during residence hall move-out. During the school year, the items produced are generally smaller and pertain to cell phones, batteries, CFLs, and data storage.

A recent waste audit of Humboldt State University found that there was no evidence of electronic waste contamination of the landfill-bound waste stream generated by Humboldt State. This indicates that electronic waste is being re-appropriated correctly, or at least amassing until a drive is held. Employees of the Office of Sustainability conduct preliminary processing on the institutional electronic waste generated during the summer. It has been economically advantageous to remove all of the major wiring and scrap metal from the institutional electronic waste before re-appropriation. Electronic waste is categorized and palletized before it is picked-up and trucked for further processing. The office of Sustainability has records of the general amount and nature of electronic waste that has been re-appropriated over the last few years. These figures represent CRT monitors separately and combine all other institutional, move-out,

and other miscellaneous electronic waste. The quantity of electronic waste generated on campus is being recorded but the rates, spatial distribution, and contents generated throughout the school year and resulting from modernization are not yet being monitored.

A new electronic waste collection system is being developed by the Office of Sustainability which will divide the electronic waste collected continuously in campus into four streams for the purposes of receiving reclamation value, participating in redemption programs, and reducing the cost of mixed electronics waste re-appropriation. According to the Office of Sustainability, a purchasing advisement plan is going to be developed in the near future to shape the nature of electronic waste generation occurring at Humboldt State University.

Problem Statement

While Humboldt State manages a vast amount of institutional electronic waste in an efficient way, limited opportunities for electronic waste disposal exist for small items especially in the residence halls, and around faculty and staff offices. Used, obsolete, and otherwise unwanted waste associated with electronics often accumulates when users have no good option for disposal. There is no positive reinforcement for proper electronic waste re-appropriation. This can be addressed with electronic waste disposal opportunities that provide a participatory experience. Successful staffed electronic waste drives have been conducted on campus, and large amounts of electronic waste are collected. However, these events take significant human energy to orchestrate and execute. Humboldt State needs semi-permanent electronic waste collection system that can be located in various locations- based on anticipated electronic waste generation; generate positive and self-contained publicity; collect significant amounts of electronic waste from an area; provide an opportunity for data collection and further adaptive electronic waste

management; and be relocated when needed elsewhere. Existing electronic waste totes are generic waste receptacles with standardized waste receptacle signage differentiating it from other recycling streams. Electronic waste is generally recognized by waste producers as hazardous and significantly different from typical solid waste; therefore an electronic waste disposal experience should be accordingly different from typical waste disposal. A disposal experience should approach the initial experience of purchasing a new electronic device, which has been culturally charged to be exciting and fun. Likewise, electronic waste collection systems should be adequately reflexive to prevailing technological trends and advances and anticipate changes in the nature, rate, and location of electronic waste generation.

Goal and Objectives*

*These goals and objectives were developed at a preliminary stage of problem definition. Subsequent research has modified our understanding of the complexity and current status of Humboldt State University's electronic waste collection system plan. For the purposes of continuity, we have preserved our original goals and objectives, followed by a discussion of their present validity.

Goals:

- Reduce contamination of electronic waste in mainstream trash
- Increase interest in electronic waste recycling receptacles
- Clearly define electronic waste receptacle locations

Objectives:

- Observe a significant decrease of in electronic waste in landfill-bound waste stream, specifically in residence hall areas.
- Observe a significant increase in electronic waste collected in existing receptacles.
- Demonstrate significantly improved electronic waste collection by increasingly engaging waste receptacles compared to standardized receptacles.
- Expand the availability of electronic waste receptacles from approx. 6 to 10

Our initial problem definition which lead to the development of these goals and objectives did not address this issue directly or capture the entire nature of the electronic waste generation problem at Humboldt State University. Based on the results of the draft waste audit commissioned by the Office of Sustainability, there is no significant problem with electronic waste contamination of the traditional landfill-bound waste stream emanating from Humboldt State University. Electronic waste being generated at Humboldt State is primarily a result of institutional technological upgrades. The development of an advisory purchasing agreement plan is an exciting opportunity to reduce the costs associated with pre-processing and re-appropriation of electronic waste. This plan has not been approved, developed, or even initiated.

The Office of Sustainability in the process of constructing newly approved multistream electronic waste receptacles to be installed within the College Creek complex and in the Jolly Giant Commons in addition to the existing electronic waste receptacles on campus. The introduction of additional electronic waste receptacles and multiple electronic waste streams provides a novel opportunity to develop a data collection system to be incorporated into the development of a purchasing advisement plan or agreement.

Solution:

We propose that part of the soon-to-be introduced multi-stream electronic waste collection system include data collection. Data regarding the generation rate and material type based on location and school week should be collected for use by the office of sustainability and independently verified and extrapolated by a class such as Engineering 308 or another statistics-based class in the math or sociology departments to shape the implementation of an adaptive purchasing advisory agreement. Basic data should be collected as part of the regular electronic waste collection process. By identifying which departments are the first to respond to technological advances by deeming older electronics obsolete, it will be possible for the Office of Sustainability to locate receptacles in an anticipatory way to capture electronic waste before it starts to accumulate.

Project Alternatives:

1. Marketing and Outreach: Develop media for HOP and recycling website with information on electronic waste receptacle locations and on the negative impacts of misappropriated electronic waste.
2. "Fun Bin" design: redesign a new multi-stream electronic waste receptacle to be more engaging and fun than a typical waste receptacle
3. No Action: the Office of Sustainability continues according to current operation standards.

Alternative 1: Marketing and Outreach

Alternative Summary: This alternative would act as a way to increase awareness of the two electronic waste recycling towers that will be installed in two separate housing locations in the fall semester 2012. If the "Fun Bin" design process is not acceptable to the administration, or there is no interested party who is capable of developing and implementing a "Fun Bin" design; marketing and outreach which could involve campus wide flyers that advertise the new electronic waste recycling towers. It could also include advertisements in the Lumberjack newspaper or one of the many campus-related social networking websites such as facebook. The main objective of this alternative would be to stimulate awareness of proper electronic waste recycling locations on campus, and the two new electronic waste bins in housing.

While marketing and outreach appear to be a highly effective means of meeting our goals, it can't be guaranteed of a change in disposal behavior. Our goal is to clearly define electronic waste receptacle locations and increase interest of electronic waste disposal on campus. Marketing using advertisements, flyers, and networking tools may not be enough to promote a change in disposal behavior but could have an impact on the general knowledge of disposal locations. This is a feasible means of outreach and of achieving our goal and there are currently multiple campus groups dedicated to producing this material.

Alternative 2: Alternate Fun Bin Design

Alternative Summary: The "Fun Bin" would be an addition to the exterior of one of electronic waste receptacle towers which are expected to be installed in August 2012. The Office of Sustainability has endorsed the idea of adding to the visual marketing in creative ways to these

new bins. This modification should occur as early as possible after the implementation of the new receptacles to ensure the greatest impact.

The idea that an electronic waste receptacle may not be determined to be aesthetically congruent to current campus standards and approval of a final design will be challenging. The “Fun Bin” will be eye-catching and could promote creativity and in those designing it, and could also have an affect on long term usage and potentially electronic consumption patterns. The “Fun Bin” can provide interesting research opportunities for multiple departments on campus, especially due to the multi-stream nature of collections. Lonny Grafman has agreed to accept an electronic copy of our qualitative report of the Humboldt State electronic waste to be reviewed as a potential statistical analysis project topic for future engineering classes. The Office of Sustainability has also approved the idea of collecting any data feasible for future student projects regarding the electronic waste stream of Humboldt State.

Alternative 3: A Cause of No Action

Alternative Summary: Continue with electronic waste disposal and implementation of the two new electronic waste receptacles in housing and dining services locations, Jolly Giant Commons and the College Creek Apartment. This alternative would allow for the continuance of the current electronic waste system on campus. Currently the majority of electronic waste being generated at Humboldt State is primarily a result of institutional technological modernization, and there is much less electronic waste collected from the regular bins around campus. Waste drives collect the majority of personal electronic waste at Humboldt State University. The two approved multi-stream electronic waste receptacles located in the Jolly Giant Commons and the College Creek apartments will proceed as planned in the fall semester of 2012.

Implementation Strategies

Our implementation strategy is centered around the new receptacles set to debut in early August of 2012. This includes an example design modifications to one of the proposed two new electronic waste receptacles to guide in further design modifications to Morgan King and TC Comet. The modifications will be applied through volunteer and organization recruitment. We have contacted WRRAP to suggest the design opportunity to them, however we have not been able to schedule proper time to discuss the issue in person. They have been informed of the new bins being installed in August. The volunteer tasks will be to to paint and complete further design the specifics of the "Fun Bin."

Methods

We have met with TC Comet and Morgan King to discuss the current status of the electronic waste collection system. They have endorsed our proposed suggestion and informally agreed to conduct future research and alternative design modifications surrounding the "Fun Bin."

Our group was able to identify some of our proposed solution categories that are either currently infeasible or do not adequately address the objectives of our project. There is no real potential to expand electronic waste processing performed by campus. Additionally, the electronic waste collection scheme has been continuously developing for many years, and a working relationship has been established with an electronic waste transport and recycling company. electronic waste drives on campus are relatively successful. Part of the success is due to the periodicity which allows for a significant amount of awareness to be spread and electronic waste to be accumulated. There are multiple organizations that perform electronic waste drives

on campus. Many of our suggested solution categories were embraced by the Sustainability Coordinator and Sustainability Director; whose suggestions and requests were very similar.

The method that we have used to identify our project solution was by evaluating the extent to which the solutions met our project objectives, and the feasibility of accomplishment. The nature of the electronic waste collection system evolves on a timescale of months and years. Most of our solutions have been set in motion at one time or another and many are in the process of being approved. The way that our group can achieve the greatest impact in improving various aspects of electronic waste collection is by a qualitative project to be presented to the Office of Sustainability; the Housing Environment and Sustainability Council; and the Engineering department that includes: a design to introduce a level of participation and fun to already proposed new electronic waste receptacles; a suggestion to begin collecting data of a spatial and multi-streamed nature of the electronic waste system on a regular basis to provide a research opportunity for multiple departments.

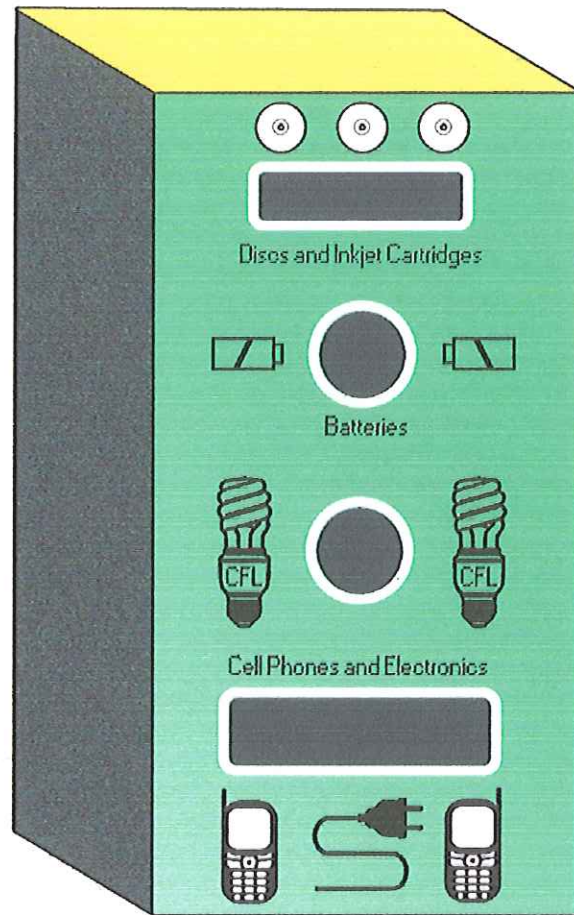
Results and Conclusion

We have obtained informal endorsements of our project suggestions and agreements to receive copies of this report. The Office of Sustainability has completed our original goals and objectives through pursuit of complete electronic waste re-appropriation. Our original problem definition did not accurately reflect the status and progress of the Office of Sustainability's management of the waste streams.

References

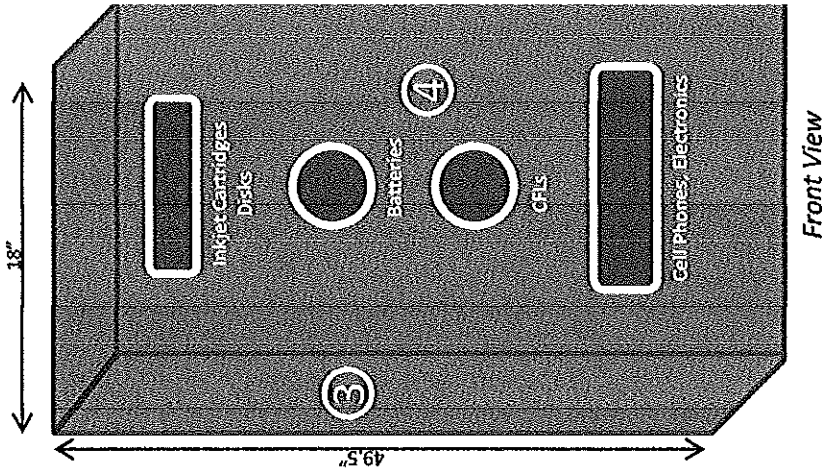
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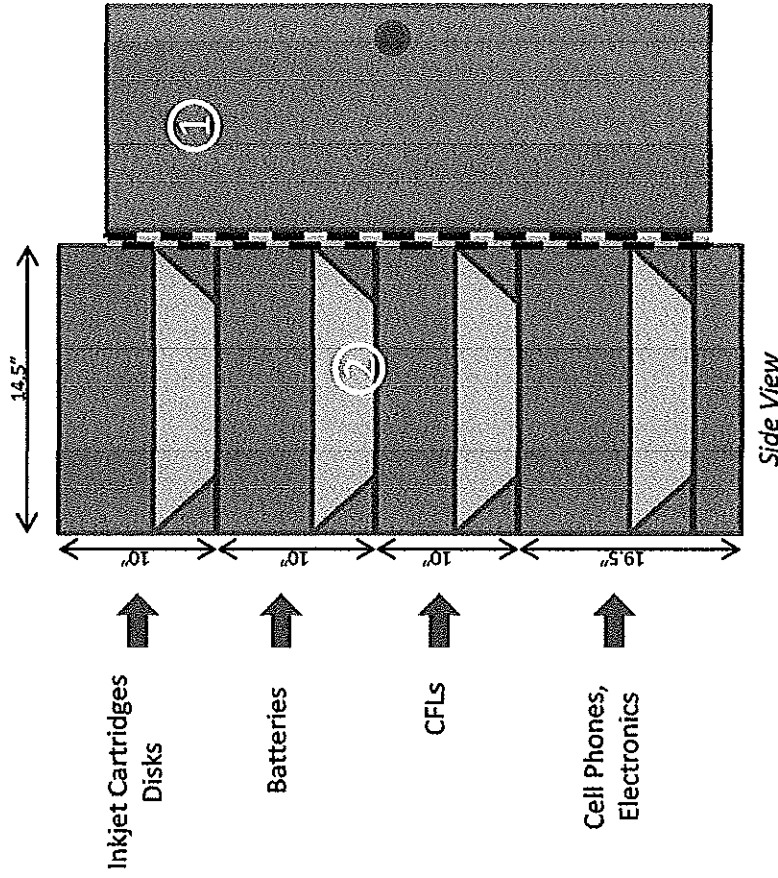


The *Fabulous* Electronic Waste
FUN BIN!

Recycle your electronic waste and have **FUN**
doing it! Coming to a HSU housing and dining
location near **YOU!**



Front View



Side View

Recycling Tower

1. Door on side of tower hinges open to access collection trays.
2. Plastic trays are approximately 16.8" long by 13.3" wide.
3. Tower constructed of 5/8" plywood with formica overlay.
4. Openings have the following dimensions (from top to bottom):
 - 3" tall by 6" wide rounded rectangle
 - 5" diameter circle
 - 5" diameter circle
 - 5" tall by 10" wide rounded rectangle

Monitoring and Evaluation Plan

Objectives	Start	Completion	Who	Frequency	Instruments
Observe a measurable decrease of in electronic waste in landfill-bound waste stream	Implementation in the fall; continuing indefinitely	The office of sustainability has already met this objective by creating a waste stream with no electronic waste contamination	Sustainability Office (Morgan & TC)	Continuous data collection of waste stream continuing in the fall	Scales, and numbers of each type of electronic waste collected and analyzed
Observe a measurable increase in electronic waste collected in existing receptacles	Implementation in the fall; continuing indefinitely	The office of sustainability has already met this objective by creating a waste stream with no electronic waste contamination	Sustainability Office (Morgan & TC)	Monitoring has already begun, but will start again as soon as the multi-waste stream is implemented in the fall and operational; data analysis indefinitely	Scales, and numbers of each type of electronic waste collected and analyzed
Demonstrate improved electronic waste collection resulting from increasingly engaging waste receptacles compared to standardized receptacles	Implementation in the fall; continuing indefinitely	The office of sustainability has already met this objective by creating a waste stream with no electronic waste contamination	Sustainability Office (Morgan & TC)	Monitoring has already begun, but will start again as soon as the multi-waste stream is implemented in the fall and operational; data analysis indefinitely	Scales; numbers of each type of electronic waste collected and analyzed;
Create design for fun bin	Estimated for May 2012	When the design is approved and fulfills the desired purpose	Julian	single occurrence	Photoshop generated image of the Fun Bin, approximate size of objects to be attached (if desired); computer program
Research on different projects etc. effective projects that we might be able to use	Before the design of the fun bin is completed, and before we turn in our project in May.	Will be completed before the design of the fun bin is finalized or could be ongoing research carried into the fall.	Kate, Julian, Kyle. Future students or faculty that implement the project	Ongoing	Primarily internet based research email
Schedule and facilitate meetings as necessary	Throughout duration of project	Meeting have been ongoing and have been completed	Kate, Kyle, Julian	Ongoing	correspondence and in-person meetings email
Regular communication with T.C. Cornet and Morgan	Throughout duration of project	Meeting have been ongoing and have been completed	Kyle	Ongoing	correspondence and in-person meetings

