

Sorting Smarter: What UW-Madison's Oscar Sort Data Reveals About Campus Recycling

By Ben Schweitzer

Abstract

This report analyzes waste disposal patterns on the campus of the University of Wisconsin-Madison using data collected by computer vision assisted waste disposal units called Oscar Sort. Data gathered from four units on campus was used to compare disposal correctness rates, track trends over time, and identify key sources of contamination. Results show Union South to be the highest performing location in terms of sorting waste correctly with both the highest recycling and trash correctness rates of the four locations. While overall correctness shows promising signs of steady increase, recycling correctness remains subpar posing a significant sustainability problem. Plastic lids and cups are shown to be the most influential items on the overall correctness rate while coffee cup lids and food-contaminated containers were found to be major sources of contamination. These findings of successes and failures of waste sorting on campus suggest that actions such as increased signage, better packaging choices, and education on separating food from containers could reduce contamination and promote a more sustainable campus.

Introduction

Waste sorting is a simple yet critical component of building a sustainable community. It is especially important in a community as large as the University of Wisconsin-Madison where thousands of items are discarded daily. While most people are aware of basic distinctions between trash and recycling, careless disposal habits add up quickly and take a heavy toll on our campus's environmental footprint.

To combat this, the University's Office of Sustainability has deployed Oscar Sort devices to aide and monitor waste disposal habits around campus. Thanks to this technology, never-before seen waste disposal data is now being collected every day in real time.

The purpose of this report is to analyze the data collected by these devices and find out where Badgers have succeeded and failed in their waste disposal habits. Using statistical analysis, trend evaluation, and pattern identification, this report highlights areas where healthy patterns have promoted sustainability and where harmful patterns have set us back. By uncovering the causes behind both, we can be more conscious of how to dispose of our waste and help build a sustainable future for the University.

What is Oscar Sort?

Oscar Sort is a smart recycling assistant that uses cameras to identify items and inform the user if that item is trash or recycling via a simple visual prompt on its screen. Thanks to this technology, the machine can identify the items being disposed of in its bin, what bin the item was placed in, and if the item is trash or recyclable.

As of August 2025, there are four of these devices at various locations on UW-Madison's campus managed by the Office of Sustainability. These locations include Memorial Union, Union South, Gordon Dining & Event Center, and Dejope Residence Hall. The data used in this report has been collected from all four of these



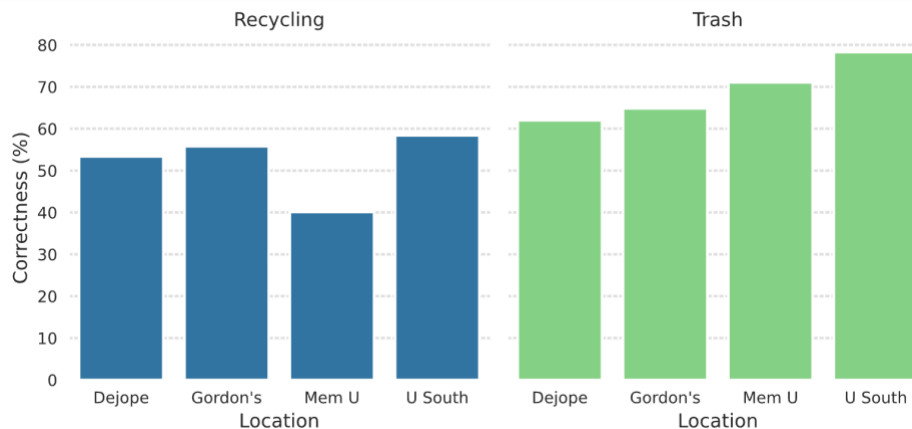
<https://sustainability.wisc.edu/oscar-sort>

locations from January through April 2025. Each row of this data tells us how many times each item was disposed of in each bin (trash or recycling) on each day that data was recorded at each location.

Thanks to this data and the guidance of Professor Yash Babar, I have analyzed and visualized this data to uncover key patterns regarding the waste disposal habits on campus. This analysis has allowed me to identify where we have gone right and where we can do better with our waste disposal habits.

***Please note: the word “correctness” is used throughout this report and is defined as the percentage of disposals that were placed in the correct bin (recyclables in recycling bin, etc.). This report is an analysis of humans’ ability to sort waste; the Oscar devices do not sort waste themselves.*

Comparing Locations



I compared the differing trends between the four devices on campus. By comparing the correctness rates of different locations, we can see which location has the best results.

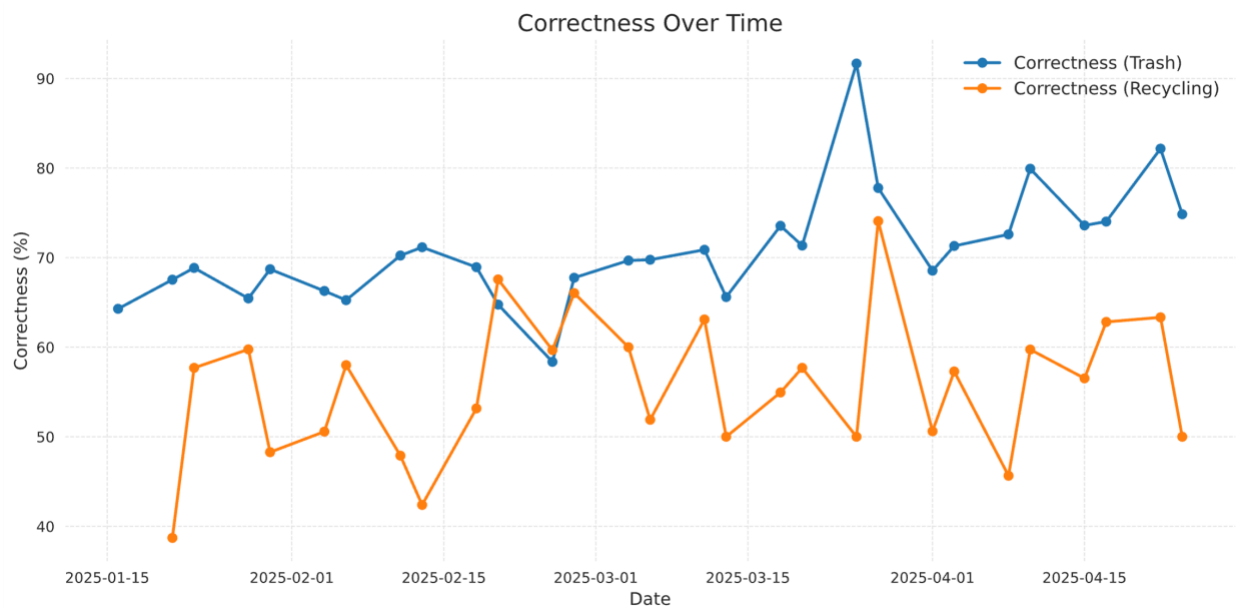
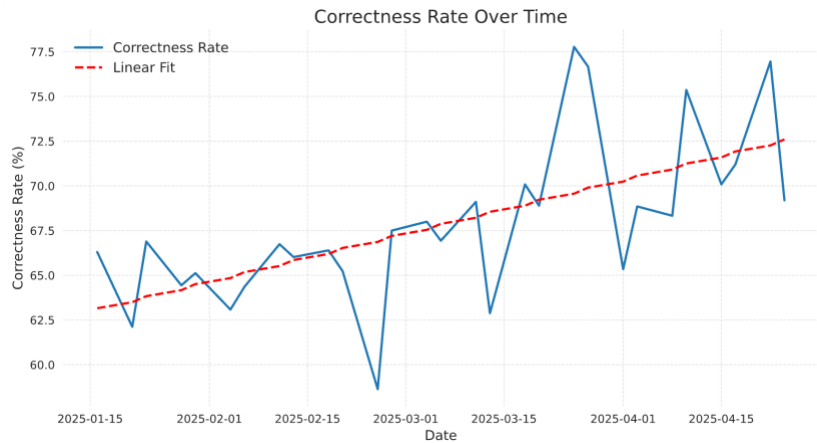
The visual gives us a clear winner and suggests that **Union South has the best waste sorting** of the four Oscar Sort devices. Both the highest trash and recycling correctness rates come from this location, proving that its exceptionally low contamination rate (percentage of disposals placed in the incorrect bin) is not skewed by a relatively higher proportion of trash. Additionally, its overall contamination rate is about 8% lower than the overall contamination rate of all four devices combined.

It is worth noting that Union South is the highest performing location for waste sorting correctness despite seeing the second highest number of disposals. Despite extremely similar levels of activity, Gordon’s Dinging and Event Center is slightly behind in recycling correctness (~0.03% difference) and significantly behind in the trash bin (~14% difference). Further research into what sets Union South apart could provide useful insights into how to promote similarly positive results at other current and future Oscar Sort devices. Union South has consistently outperformed its counterparts, making it a model for waste disposal systems on campus. Understanding the factors behind this success could inform strategies to replicate its performance.

Correctness Over Time

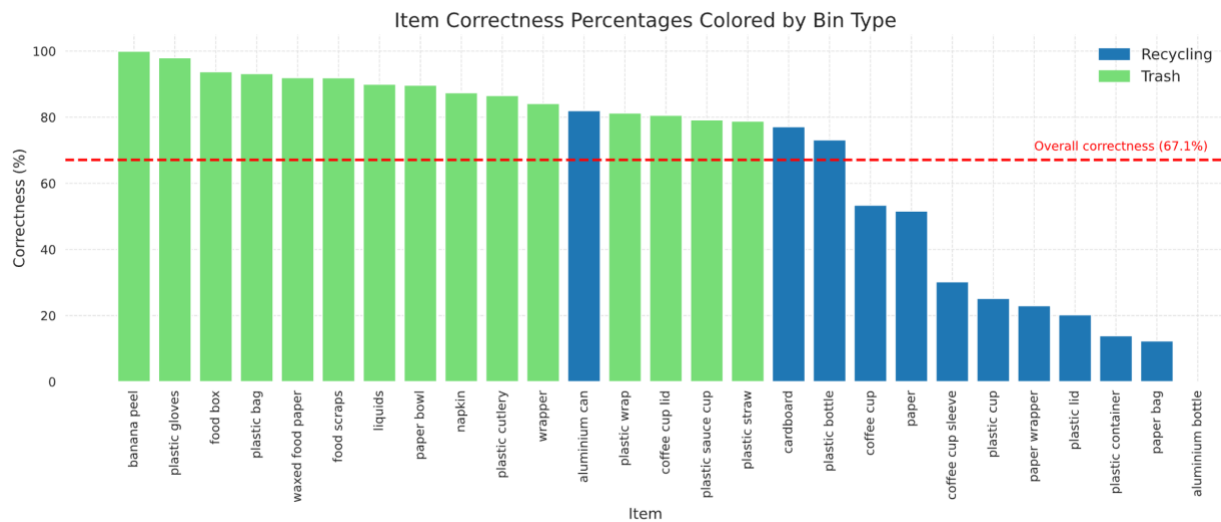
An easy way to get a grasp of the current state of waste sorting on campus in Oscar Sort devices is to look at how correctness has changed over time. The first plot shows the overall correctness rate as it changes over time starting from the day the devices went online (January 14) through April 8. The red line showing the linear fit of this trend indicates a steady

increase in correctness over time. The optimistic explanation for this is that as those who interact with the Oscar Sort devices interact with them repeatedly over time with different items, they learn more about which items belong in which bins thus increasing their waste sorting abilities. This is the goal of the Oscar Sort machines, so hopefully we can see a continuation of this trend and movement towards a more sustainable campus.



As we break this plot into two separate lines for trash and recycling, we see how the correctness of each differs. The correctness of disposals in the trash bin has almost always exceeded that of disposals in the recycling. While the two bins see similar rises and falls in correctness during specific time periods, there is no doubt that recycling causes more difficulty when it comes to correct disposals. As we are about to see in the next section, this proves to be a quite problematic situation.

The Recycling Problem



While any kind of waste stream contamination is harmful, it is unfortunately true that contaminating the recycling bin is worse than the trash bin. This is because if recycling is placed in the trash, the only harm is a missed opportunity at recycling. However, if trash is placed in the recycling, it can soil many recyclable items already in the bin, ruining their chance of being recycled later.

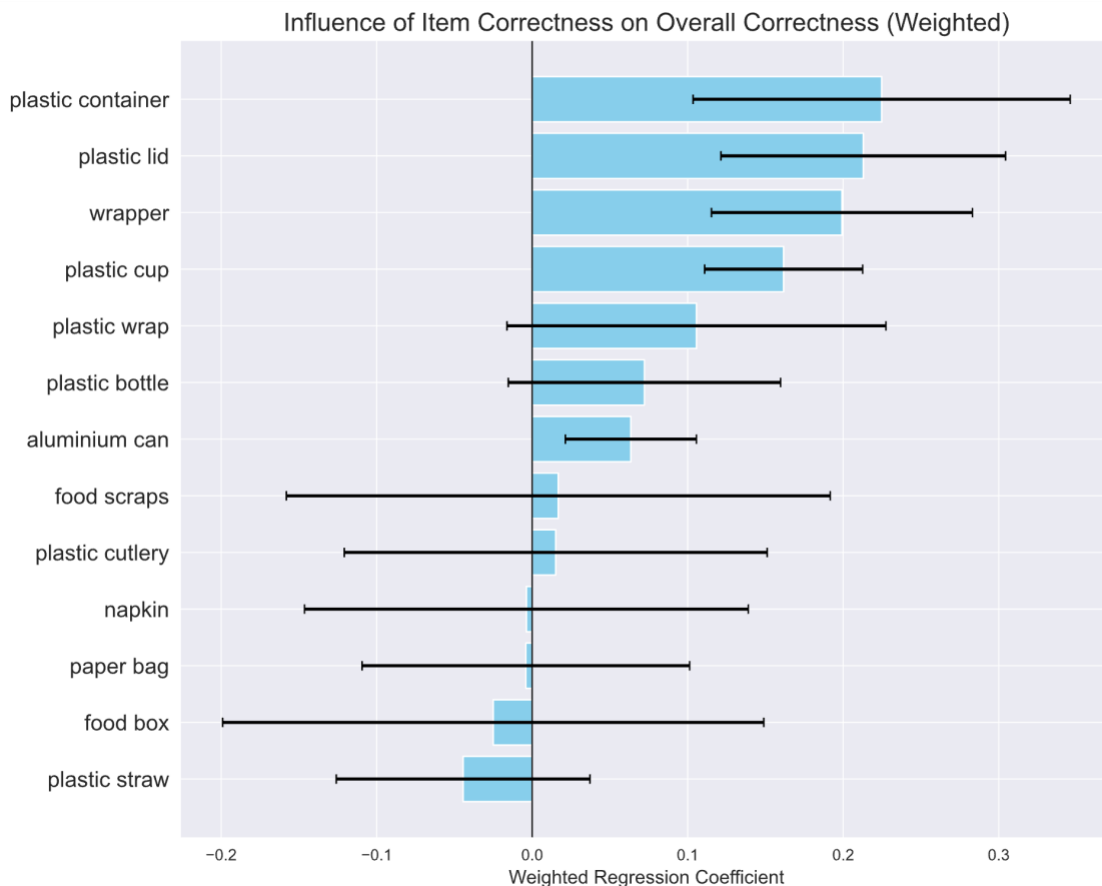
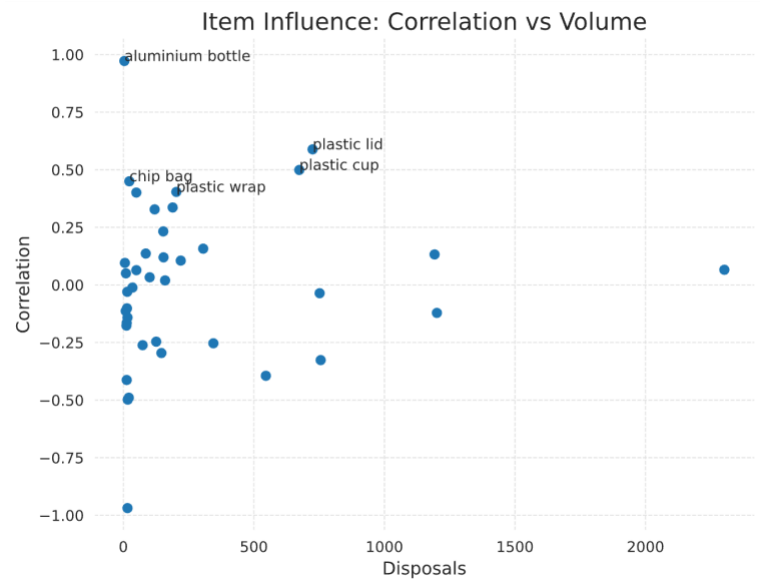
What makes this so unfortunate is the clear sign that recycling correctness is consistently behind trash correctness. The graph above depicts the correctness rates of each item, showing the clear distinction between the generally high correctness of trash items and generally low correctness of recyclables. With an overall correctness of 55.62% compared to 70.86% for trash, there clearly is a need to prioritize fixing the way recycling is sorted by those on campus to create a more sustainable waste stream and campus.

The Oscar Sort devices are an excellent initiative to help encourage better recycling, but they do not sort the waste for you they simply nudge you in the right direction. For this reason, additional efforts such as posting signage near waste bins and usage of clearly marked recyclable items by vendors on campus can go a long way in closing this gap and making UW-Madison more sustainable. Despite any outside efforts made, it all comes down to how each member of our community handles their waste. It may seem small, but every time you take a second to think before tossing away an item, you are helping. Those couple seconds it takes, repeated thousands of times a day across campus, can quickly add up and improve our overall recycling correctness.

Item-Correctness Correlation

By calculating the influence that the correctness of each individual item has on the overall correctness of disposals across campus, we can learn which items have the greatest influence on the overall correctness rate. This will give us an idea of some of the most important items to dispose of correctly.

I started by calculating the Pearson correlation value for each item. The closer the value is to 1, the more positive linear correlation there is between that item's correctness and the overall correctness. This means the item has a stronger influence on the overall correctness rate and therefore is an important item. Any value less than or near 0 indicates no positive linear correlation, meaning the item does not have much influence on overall correctness. The scatter plot shows these values for each item on the y axis while showing the volume of disposals on the x axis. To find our most important items, we are looking for items with high correlation values as well as high volumes of disposals. The scatter plot reveals two solid candidates: plastic lids and plastic cups.



To further support my findings, I decided to recalculate correlation using weighted least squares regression so that the values are weighted by the volume of disposals. In other words, this kind of

calculation now takes the volume of disposals into account. The horizontal bar plot shows the results. The top items in terms of correlation in this calculation are plastic containers, lids, and cups as well as wrappers.

As **plastic lids and plastic cups** are the only two items to show strong correlations in both calculations, I deem these to be the most important items to dispose of correctly. These two items make up **30% of all contaminants** recorded by Oscar Sort, so it is critical that these items are disposed of correctly if we want to see higher correctness rates across campus. Posting signage about the recyclability of these items and ensuring these items are clearly marked as recyclable could encourage more successful habits and increase overall correctness.

Associated Contaminants

To get a better idea of which items are the most problematic, I used association rule mining to see which contaminating items are frequently disposed of in the same bin on the same day. The results are shown in the table. Antecedents are the items being observed while consequents are the items we predict will be disposed of given the observation of the antecedent. Lift is a metric that means the occurrence of the consequent given the antecedent is X times more likely than random chance. This is the metric we use to judge the validity of the associations.

antecedents	÷	consequents	÷	lift	÷
(coffee cup)		(coffee cup lid)		2.182685	
(coffee cup lid)		(coffee cup)		2.182685	
(coffee cup sleeve)		(coffee cup lid)		1.990321	
(banana peel)		(coffee cup)		1.839800	
(waxed food paper)		(coffee cup)		1.820331	
(plastic bag)		(coffee cup)		1.743643	
(paper bag)		(food scraps)		1.701170	
(coffee cup)		(food scraps)		1.592585	
(plastic bag)		(plastic container)		1.560595	
(banana peel)		(plastic container)		1.544118	

As the most seen item in the table, **coffee cup lids** appear to be the most problematic item as they are present in the top 3 contamination associations. With coffee cup lids being labeled as trash and the rest of the coffee cup (the sleeve and the cup itself) being recyclable, it is easy to see how this could generate a lot of contamination. For this reason, it could make a very large difference in the overall contamination volume if recyclable coffee cup lids were used instead.

The other biggest issue beyond this seems to be failure to **separate food scraps from recyclable food containers**. A great way to address this and promote less contamination in the waste stream could be to advertise scraping or dumping food waste into the trash before disposing of containers in the recycling. Simple signage sharing this guidance on signs near waste containers as well as on the screens of the Oscar Sort devices could go a long way in promoting better waste sorting.

Summary

- **Union South is the best** performing Oscar Sort location, making it an example for current and future implementations of Oscar and waste containers across campus
- We're seeing a **promising increase** in overall correctness, but **low recycling rates** are limiting progress
- **Problematic recycling** contamination is prevalent. Preventing it needs to be a **priority** if we want our campus to be more sustainable
- **Plastic lids and cups** are some of the most **crucial** items to sort correctly to prevent contamination
- Failing to **separate coffee cup lids** from their cups and **food scraps from plastic containers** are additional common causes of contamination

By **understanding our failures and successes** in waste sorting, we can all play a role in creating a more sustainable campus. The Oscar Sort machines are amazing tools, but they cannot do the work for us. I hope that you **take the findings from this report and turn them into action** in your everyday life. It may not seem like much, but if we all take a second to stop and think any time we throw something away, we can shape the sustainability of our campus.

Jupyter Notebook

If you are interested in seeing the complete Jupyter notebook I worked in for this report, which includes additional visualizations and analysis as well as my Python code, follow the link [here](#).