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# Soda Pop Zombies: Soft Drink Consumption and Motion

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## ABSTRACT

In this position paper, we examine a clear inverse correlation of soft drink consumption and overall motion sensor activation within the Massive Dataset. Several hypotheses are posited and tested with the results of a survey of lab members.

## Categories and Subject Descriptors

J.4 [Social and Behavioural Sciences]: Psychology.

## General Terms

Measurement, Human Factors.

## Keywords

Building activity, soda pop, human resources

## 1. Introduction

The ‘Massive Dataset’, released by Mitsubishi Electric Research Labs, contains activation data of 200 motion sensors within their lab over a one year period [2]. In addition to the various sensors mounted in hallways and outside of offices, a single sensor (the ‘soda sensor’) was installed in the bottle return of a soda pop (‘soda’) machine, frequented by a large number of MERL employees. Though active for only a 4 week period, this sensor enabled the detailed recording of the number and timings of soda bottles dispensed. Interestingly, in the middle of the 2<sup>nd</sup> of these 4 weeks, the machine ran out of soda. Examining the activations of the soda sensor alongside data from the other sensors allows us to examine the correlation between soda consumption and overall activity.

In order to examine this correlation, we collapsed the activation of all of the sensors within the lab, with the exception of the soda sensor, to a single “total motion” variable, and compared this with the activation of the soda sensor. Figure 1 shows the levels of these two variables over the 4-week period that the soda sensor was operational. The emptying of the machine is apparent in the middle of the second week.

The machine’s electronics were not instrumented, as has been done previously [1]; dispensing data comes only from activation of the motion sensor within the bottle return. Because of this, it is impossible for us to know with precision when the last soda was

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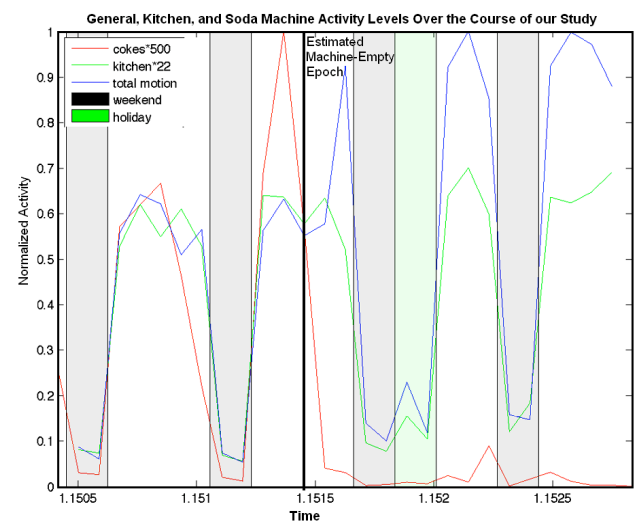
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retrieved from the machine. We infer the timing of the emptying of the machine with the sudden drop-off of sensor activations during the second week of data. We attribute the rapid decline (rather than a cliff) to a period during which the most popular soda selection was not available, while lab members were exhausting the alternatives. The activations during the third week may come from unpopular choices being dispensed after hope of replenishment of preferred choices was exhausted, or to hopeful pawing by desperate lab members.

Figure 1 shows a clear change in the overall motion in the lab during the period after the emptying of the machine. The levels of the two variables have been normalized to the first week. Two immediate trends are apparent: first, the activity level within the lab is fairly consistent during those times that soda is available. Second, following the time which we estimate as the extinction of the availability of soda, motion sensor activity in the lab significantly *increases*.

## 2. Soda at MERL

In order to gain a better understanding of how soda consumption might affect physical activity, we now turn our attention to the details of that consumption within MERL. Although the machine is designed to enable the purchase of soda, it is set to dispense bottles free of charge, with no controls imposed to in any way limit consumption. This machine is accessible only to MERL employees, interns, and other visitors to the lab.



**Figure 1. Sensor activations over a 4-week period for the soda machine sensor (red), kitchen activity sensor (green), and all sensors (blue). Red and blue normalised to 1.0 (peak), green to 0.7 (peak). In the middle of week 2, the machine ran out**

MERL keeps no formal records of typical consumption by individual employees. In order for us to gain a better understanding of the consumption of soda within the lab, we asked all members to take a brief survey. The sample was not statistically selected, but our high response rate (53 respondents among approximately 70 employees) allows us to consider this a reasonable approximation of typical consumption. Figure 2 shows the response to “Considering only the days that you are working at MERL, how much soda do you drink?”

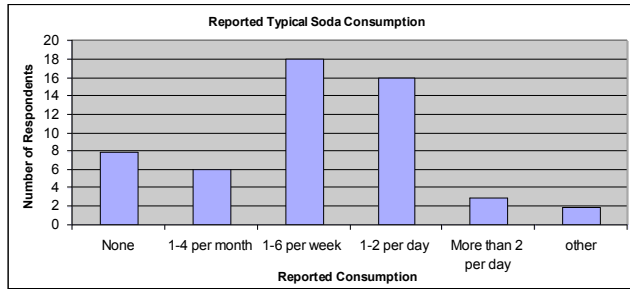


Figure 2. Typical soda consumption reported by respondents

As we see in the figure, the majority of respondents (37 of 53) report consuming at least one soda per week, indicating that use of the free vending machine is widespread among the members of the lab. This suggests that, if indeed the unavailability of free soda causes a change in an individual’s behaviour, it is reasonable that this change would have a noticeable effect on *overall motion*.

### 3. Hypotheses

We present three hypotheses for the inverse correlation of soda consumption and overall motion. First to be considered is the null hypothesis, that there exists no causal relationship between our two variables. Although we have presented evidence that our dependent variable is sufficiently sensitive to changes in behaviour caused by the lack of soda, we have no statistical basis for rejecting the null hypothesis. The remainder of this paper, therefore, presents only our conjecture.

Our second hypothesis is that the lack of soda causes individuals to seek alternative beverages, but only *after* they first check to see if soda is available. Because the soda machine is far from the kitchen, and few offices are located such that the kitchen is on the route back from the machine, this would lead to an increase in activity. To examine this, we asked survey participants “When the ‘free soda’ machine is empty, which of the following is your most likely alternative”. As Figure 3 shows, of the 45 respondents who reported as soda drinkers, 30 reported alternate beverage choices that were available in the kitchen (coffee, tea, or water).

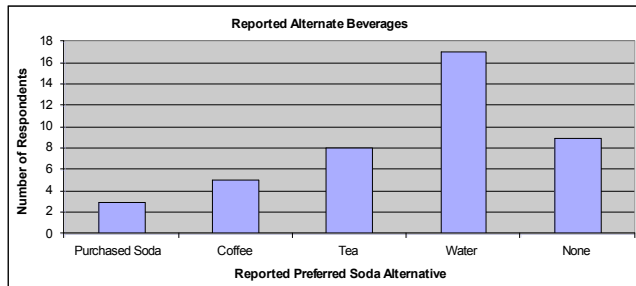


Figure 3. Alternative beverage reported by soda drinkers

Figure 1 does reveal a moderate increase in kitchen in the days following the emptying of the soda machine, but the level of the increase does not account for the entirety of the increase overall.

Our final hypothesis is that when soda is available, lab members are more likely to spend time at their desks, reducing motion: that the beverages act as a catalyst for increased productivity. We asked those who drink soda “When you are able to acquire your soda from the machine, what effect would you say it has on the amount of time spent at your desk?” As we see in Figure 4, 19 of 41 respondents reported that they believe that the availability of soda resulted in spending more time at their desk.

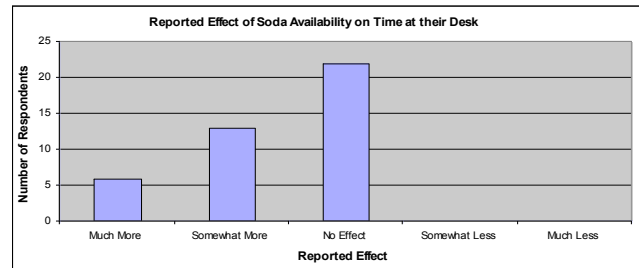


Figure 4. Respondents’ reported effect of soda availability on the amount of time spent at their desk

Even more intriguing is the response to a follow-up question: “How would you rate the productivity of the time spent at your desk while drinking a soda?” As we see in Figure 5, 16 of 40 report increased productivity, with 3 reporting a decrease.

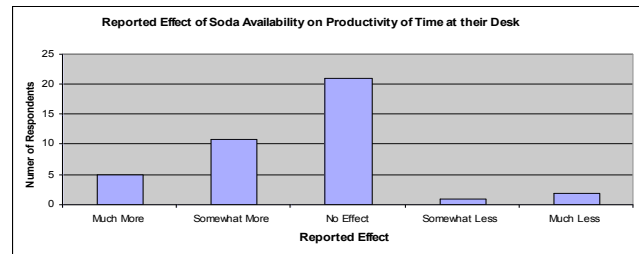


Figure 5. Respondents’ reported effect of soda availability on productivity of time spent working at their desks

### 4. Conclusions and Future Work

There is insufficient evidence to accept or reject any but the null hypothesis. What our results do suggest, however, is that a motion sensor array, such as the one that was installed at MERL, may provide human resources personnel with a means to test the efficacy of various programs designed to increase productivity.

To properly answer the question of a connection between the free availability of soda and physical movement, three significant changes would be required to our methodology: first, days when soda is available would need to be controlled, perhaps by randomly disabling the soda machine. Second, more precise measure of the nature of movement, both before and during periods of no soda, are needed. Last, a more precise means of measuring ‘productivity’ during low-movement times is required.

### 5. REFERENCES

- [1] Internet Coke Machine [www.cs.cmu.edu/~coke/](http://www.cs.cmu.edu/~coke/)
- [2] Wren, Ivanov, Leigh, Westhues (2007). The MERL Motion Detector Dataset. *MERL Technical Report TR2007-069*.
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