# Student Time Loss as an Effect of Delayed Buttery Opening Times

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**Abstract**

*Belated college-buttery opening times are among the worst nightmares of the Oxford student. We hint on potential negative effects of this phenomenon on student life and college experience. The focus is laid on measurable effects, in particular the time spent by students queueing for food rather than studying or making effective use of their free time. We show that the relationship is linear and considerable in magnitude.*

The buttery of University College of the University of Oxford has a fantastic reputation of serving some of the best food in Oxford, but a shady history of belated opening times. The aim of this study is to find the relationship between buttery opening times and student time wasted in queues.

## I. Observations and Assumptions

The following observations have been conducted by the author over a period of 3 years:

- Buttery never opens early
- Buttery opens on time approximately half of the time
- Time to serve a student is around 10 seconds, or approximately 0.12 minutes
- The highest flow of students into the buttery is around 5 minutes after opening
- Ten minutes after opening around 60 people would have entered the buttery/joined the queue
- At some point in time, the queue disappears and the incoming students no longer wait in queue. Students arriving before that time are collectively referred to as the "initial wave of students", or just "initial wave"
- On October 15$^{th}$ 2014, the buttery opened for dinner 12 minutes late

Assumptions made:

- If buttery opens late, the opening times are distributed according to a half-normal distribution[1], with the base normal distribution averaging being-on-time with a standard deviation of 5 minutes.
- Students arrive at queue/buttery according to normal distribution with a mean of being 5 minutes late and standard deviation of 5 minutes. Hence, the initial wave is approximately 70 people large.

## II. Method

We discretize time into 15-second intervals, simulate the situation with 1000 iterations and observe results. I have chosen to use a combination of Bash and Anglican for the implementation. Buttery opening time, student arrival times, and butter total waiting time are treated as random variables and together form a simple intuitive Bayesian Network. Details can be inferred from *Listing 1*, which is the used program code.

The script is first processed by Bash[2], then by Anglican[3]. Anglican lacks loops, functions, arrays and other essential constructs. For the purposes of this study, Bash was used to get around some of those issues, but this is highly unsatisfactory. One of the effects was the necessity to fix the number of students coming in the initial wave. No inference functionality of the framework was tested in this study.

## III. Results

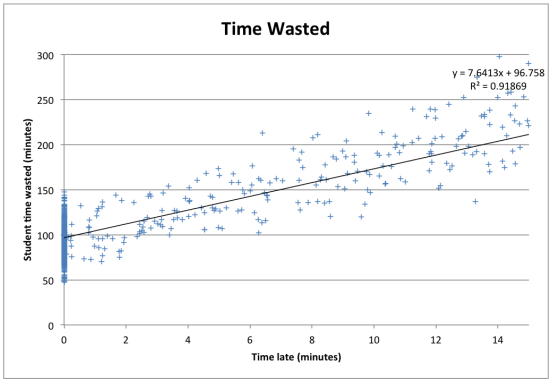


*Figure 1: Time late vs. Total student time wasted*

Relation between how late the buttery opens (x in minutes) and student time wasted seems to be linear (as seen in *Figure 1*), best-approximated by function

$$y = 7.6413x + 96.758$$

Hence, about 97 minutes of student time is wasted even when buttery opens on time and every additional minute late adds about 7.6 minutes of wasted student time. In particular, belated University College buttery opening for dinner on October 15$^{th}$ 2014 caused a waste of approximately 188 minutes (over 3 hours) of student time.

## IV. Remarks

Formally observed data is necessary for a more accurate analysis. Further study is encouraged into the health effects of standing in a buttery queue for prolonged periods of time, psychological risks involved in waiting in a buttery queue for food, value of student time wasted throughout the existence of University College (the oldest Oxford college[4]), comparison of buttery waiting times across Oxford colleges.

## V. References

[1] Wolfram MathWorld: Half-normal distribution
`http://mathworld.wolfram.com/Half-NormalDistribution`
[2] GNU Bash
`http://www.gnu.org/software/bash/`
[3] University of Oxford: Anglican
`http://www.robots.ox.ac.uk/~fwood/anglican/index.html`
[4] University of Oxford - College Listing: University College
`http://www.ox.ac.uk/admissions/undergraduate/colleges/college-listing/university-college`

*Listing 1: Code*

```
#!/bin/bash

#number of minutes late
echo "[assume ready_time (normal 0 25)]"
#buttery NEVER opens early
echo "[assume opening_time (if (> 0 ready_time) 0 ready_time)]"
time_to_serve_student=0.12
time_interval=0.25

#for every student
for i in ‘seq 0 69‘;
do
     echo "[assume student${i} (normal 5 25)]"
done

#for every time step - observe over 30 minutes of time
for t in ‘seq 0 119‘;
do
     #total time waited after official opening time
     echo "[assume waiting_${t}_raw (- (sum (list "
     for i in ‘seq 0 69‘;
     do
          echo "(if (< student${i} (* $time_interval $t)) 0 1)"
     done
     #subtract number of people already served
     echo ")) (* (/ $time_interval $time_to_serve_student)"
     echo "(if (> 0 (- $t opening_time)) 0 (- $t opening_time))) )]"
     echo "[assume waiting_${t} (if (> 0 waiting_${t}_raw) 0 waiting_${t}_raw)]"
done

echo "[assume waiting_total (* $time_interval (sum (list "
for t in ‘seq 0 119‘;
do
     echo "waiting_${t} "
done
echo ")))]"

echo "[predict (list opening_time waiting_total)]"
```