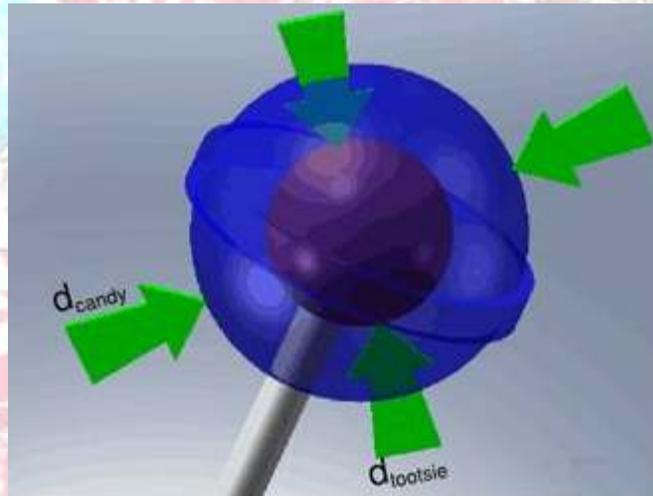


# **How Many Licks?**

**Jeffrey Russell**  
**Room 23**  
**5<sup>th</sup> Grade**

# Question

- How many licks does it take to get to the tootsie roll center of a Tootsie Pop?



# Hypothesis

- I think it will take about 200-300 “licks”

# Equipment and Materials

- Human process
  - Tootsie pops
  - Human subject with available tongue
  - Tally counter
- Machine process
  - Tootsie pops
  - Water (represents saliva)
  - Licking machine
    - Motor, wheels, foam, wood structure, bolts and washers, rubber drive belt, suede (simulated tongue surface), and water tub.
  - Tally counter

# Procedure

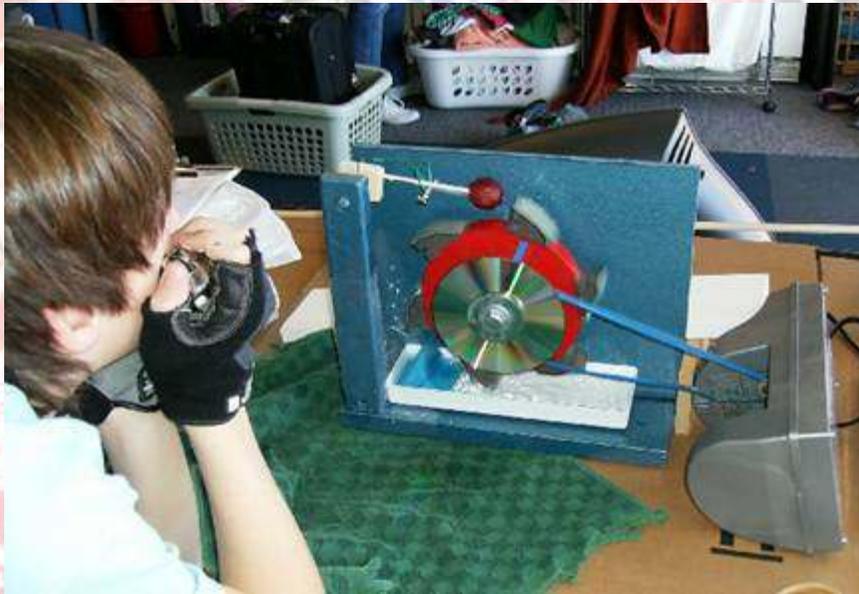
- Human
  - Un-wrap tootsie pop
  - Get tally count & reset to 0 if needed
  - Lick tootsie pop and click tally counter for each lick
  - Periodically check progress, increase frequency closer to center.
  - Once center exposed, stop and record total on tally counter
- Machine
  - Un-wrap tootsie pop
  - Get tally count & reset to 0 if needed
  - Cycle licking machine once to wet suede surfaces
  - Rock tumbler motor (fast): Place tootsie pop on machine, turn on motor, and click tally counter for each turn of the wheel (6 licking surfaces in one cycle).
  - Variable speed drill (slow): Place tootsie pop on machine, pull drill trigger until the wheel turns slowly, and click tally counter for each lick.
  - Periodically check progress, increase frequency closer to center.
  - Once center exposed, stop and record total on tally counter, the multiple by 6 to obtain total lick count (Note: accuracy +/- 6 licks)



Measuring tongue for machine pads



Counting human licks

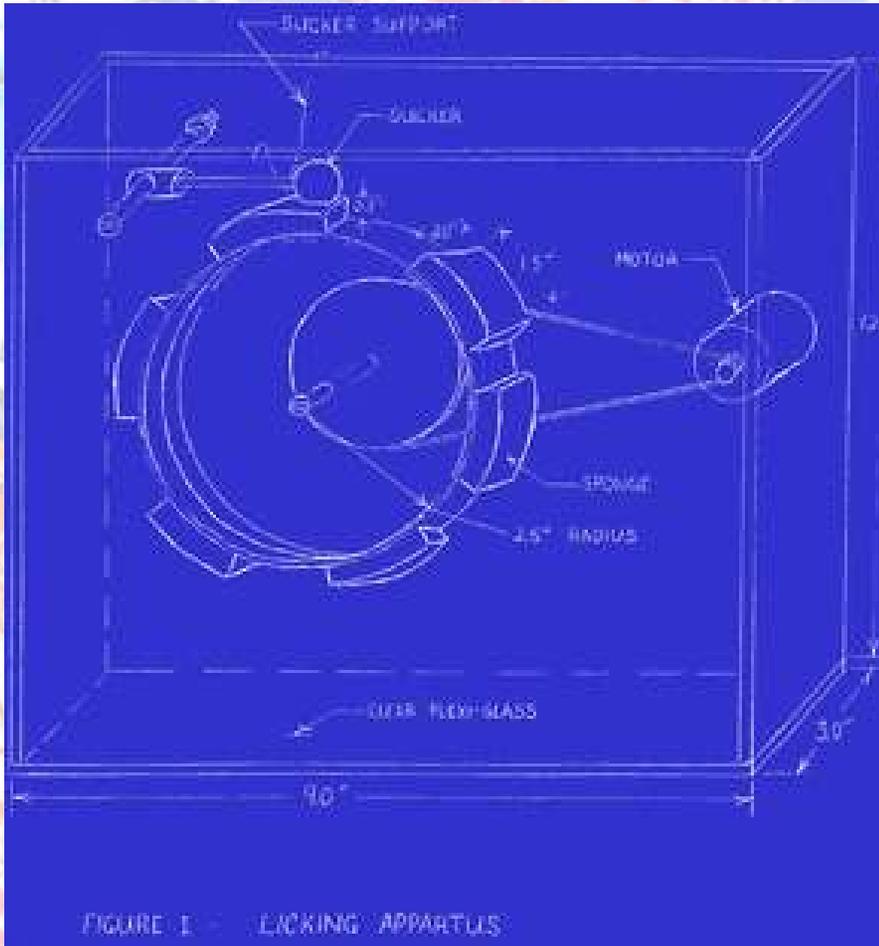


Licking machine in action

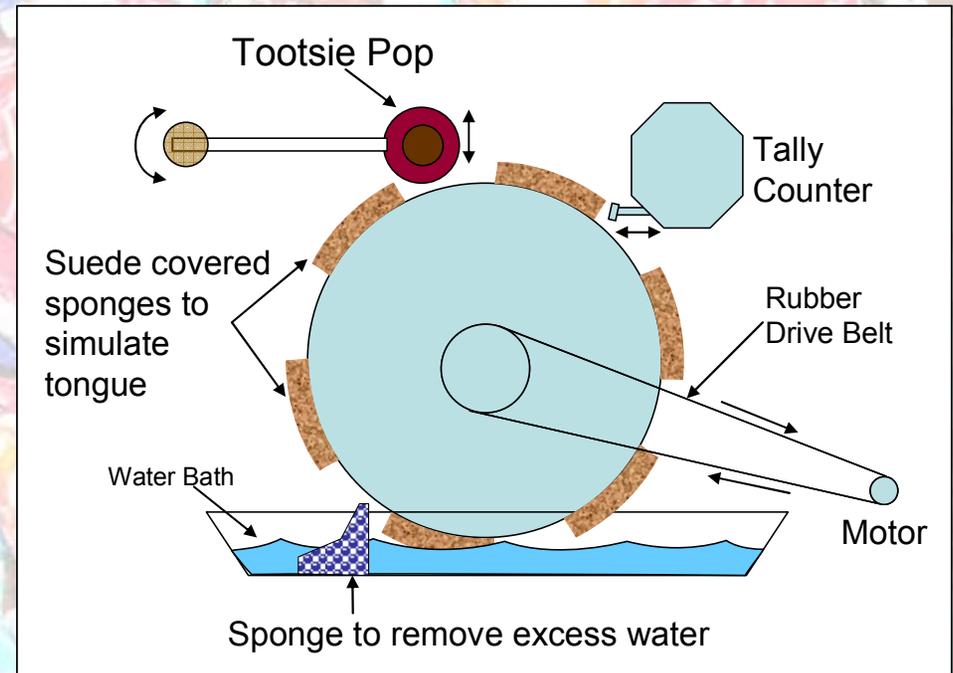


Results of normal human licks

**My machine design was influenced by previous studies in the field of Tootsie Pop research**



**Purdue University licking machine**



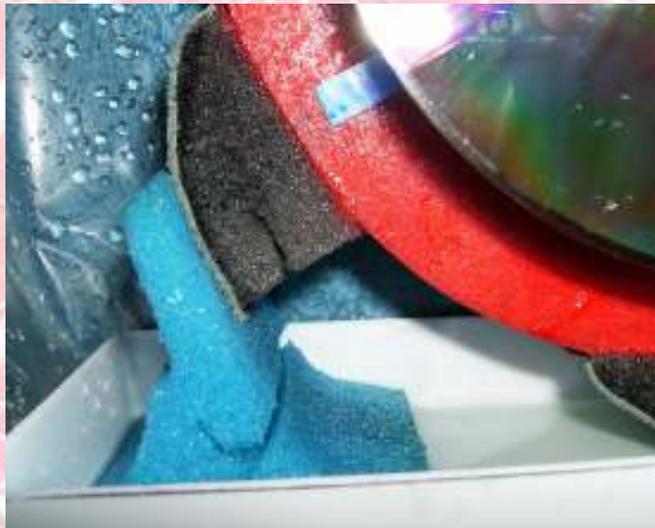
**My licking machine design plans**



**Rock tumbler motor (fast)**



**Variable speed drill (slow)**



**Sponge to remove excess water**



**Suede covered sponges to simulate tongue**

# Results

- After performing a few tests it was observed that the human licks were significantly less than the machine licks.
- I guessed that the high speed of the rock tumbler motor machine licks might account for this - so I did the human licks at a much faster pace and got closer to the machine lick count.
- I ran the licking machine at a slow pace using a variable speed drill and found that the slower licks removed more candy surface.

# Data Collection

Test	Lick Application	Speed of Licks	Number of licks to Chewy Center	Observations
1	Human	Normal	507	some smaller licks than others
2	Human	Normal	223	long licks
3	Human	Normal	400	nothing special
4	Machine	Fast	1320	lots of center exposed
5	Machine	Fast	1080	center just showing
6	Machine	Fast	1380	
7	Human	Fast	1035	
8	Human	Fast	1147	
9	Human	Fast	812	hit air bubble that exposed center
10	Machine	Slow	166	
11	Machine	Slow	306	
12	Machine	Slow	616	small center

Human Slow Average	376.7	} Slow Avg: 370 Licks	} Overall Avg: 749 Licks
Machine Slow Average	362.7		
Human Fast Average	998.0	} Fast Avg: 1129 Licks	
Machine Fast Average	1260.0		

# Conclusions

*The slower you lick the more candy coating is removed and faster you get to the center of the Tootsies Pop (average normal licks = 370).*

*I liked doing the human test more than the machine test.*



## Follow-up Question

Are some Tootsie Pops flavors tougher (need more licks) than others?





**Question**  
How many licks does it take to get to the center of a Tootsie Pop?



**Hypothesis**  
I think it will take about 200,000 licks.

My machine design was influenced by previous studies in the field of Tootsie Pop research.



**Equipment and Materials**

- Tootsie Pops
- Lollipop machine
- Stopwatch
- Ruler
- Scale
- Camera
- Computer

**Procedure**

1. Place the lollipop in the machine.
2. Turn on the machine.
3. Start the stopwatch.
4. Watch the lollipop being licked.
5. Stop the stopwatch when the lollipop is completely licked.
6. Record the time.
7. Repeat the process for 10 lollipops.
8. Calculate the average time.
9. Calculate the number of licks per second.
10. Calculate the total number of licks.

**Data Collection**

Lick Number	Time	Machine/Person
1	10	Machine
2	10	Machine
3	10	Machine
4	10	Machine
5	10	Machine
6	10	Machine
7	10	Machine
8	10	Machine
9	10	Machine
10	10	Machine
11	10	Machine
12	10	Machine
13	10	Machine
14	10	Machine
15	10	Machine
16	10	Machine
17	10	Machine
18	10	Machine
19	10	Machine
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191	10	Machine
192	10	Machine
193	10	Machine
194	10	Machine
195	10	Machine
196	10	Machine
197	10	Machine
198	10	Machine
199	10	Machine
200	10	Machine

**Results**

After performing 100 licks it was predicted that the lollipop will take 100 licks to get to the center of the lollipop.

- I predicted that the lollipop machine was 100% more accurate than the human.
- I tried the lollipop machine at a slow pace using a lollipop and found that the lollipop was removed more easily.

**Conclusions**

The lollipop machine was 100% more accurate than the human. The lollipop machine was 100% more accurate than the human. The lollipop machine was 100% more accurate than the human.

**The POPPS LICKING MACHINE**  
As a Solution to All People

The POPPS LICKING MACHINE is a solution to all people. It is a solution to all people. It is a solution to all people.

Jeffrey A. Russell





Back up slides

# Conclusions

- The slower you lick the more candy coating is removed and faster you get to the center of the Tootsie Pop (average normal licks = 370).
- I liked doing the human test more than the machine test.

## Follow-up Question

- Are some Tootsie Pops flavors tougher (need more licks) than others?

