

# Electric Toothbrush Redesign

Team 7

Engineering Design 100

Section 024

Prof. Bilen

Colin Kaye, Alberto Vargas,  
Mike Karpowicz, Alex DeCoste

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# Mission Statement

The goal for our team was to take a toothbrush that was given to us and redesign said toothbrush to be a more successful product on the marketplace. We strive to meet all customer needs as well as more efficiently produce the toothbrush, making the redesign beneficial to both parties.

# Our Product

# GUM Crayola



# Benchmarking

From the activity of benchmarking our toothbrush and comparing with others, we came up with what we thought were the most important elements to look for in a toothbrush.

1. Battery accessibility
2. Battery Life
3. Cleaning ability
4. Grip Bristle Durability
5. Quietness
6. Timer
7. Lightweight
8. Aesthetics
9. Cheapness



# Benchmarking

	Battery accessibility	Battery Life	Cleaning ability	Grip	Bristle Durability	Quietness	Timer	Lightweight	Aesthetics	Cheapness
GUM	2	4	3	2	4	3	1	4	5	4
Colgate 360 Optic White	4	3	5	4	3	5	1	3	4	3
Oral B type 3744	2	3	4	5	4	4	5	2	3	2
Arm and Hammer Spin Brush	2	3	4	3	4	3	1	3	2	3
Colgate NAEGMBDOPBAG	3	2	4	3	2	3	1	5	3	5
Oral B Pulsar	2	3	3	4	3	3	1	5	4	4
Up and Up	4	5	4	2	2	4	1	1	3	2

We compared our toothbrush with many others to see how ours ranked. In each scenario, a certain toothbrush would have great qualities in one region but there are always tradeoffs. In our redesign, we aim to reduce these tradeoffs and combine the good qualities of each toothbrush to create the most efficient brush.

# Patent Search

The following are general patents that involve electric toothbrush and the materials that comprise them.

- 1. US 6178579 B1** Jan 30, 2001
- 2. US 6000083 A** Dec 14, 1999
- 3. US 6189693 B1** Feb 20, 2001
- 4. US 6360395 B2** Mar 26, 2002

# Customer Needs Assessment

After talking to the consumers, we have taken their needs and interpreted them in such a way that we can create a hierarchy of needs. The more a consumer answered a specific quality of a brush, the higher we ranked the need. The needs come as followed:

Customer Need	Interpreted need	heirarchy
Water gets inside the brush	Need a way to keep water out of brush	5
It would be nice to have an easier way to switch the battery	The battery is easily accessible	2
The battery doesn't last long enough	Toothbrush needs longer battery life	4
I need to clean plaque	Toothbrush must clean plaque	5
Toothbrush is slippery when wet	Toothbrush must be easy to hold	2
The bristles wear out too easily	Toothbrush needs long lasting bristles	3
It makes a lot of noise	Toothbrush must be quieter	3
I want to know how long to brush my teeth	Toothbrush needs to let users know how long to brush teeth	3
It is a little to heavy for my child	Toothbrush must be lightweight	2
It always gets knocked over	Toothbrush must be able to stay upright	1
I want the toothbrust to look cool	Toothbrush must have positive aesthetic value	1
I don't want to spend a lot of money	Toothbrush must be be cost effective	4



# Customer Need Analysis

	Battery accessibility	Battery Life	Cleaning ability	Grip	Bristle Durability	Quietness	Timer	Lightweight	Aesthetics	Cheapness	
GUM	2	4	3	2	4	3	1	4	5	4	
Colgate 360 Optic White	4	3	5	4	3	5	1	3	4	3	
Oral B type 3744	2	3	4	5	4	4	5	2	3	2	
Arm and Hammer Spin Brush	2	3	4	3	4	3	1	3	2	3	
Colgate NAEGMBDOPBAG	3	2	4	3	2	3	1	5	3	5	
Oral B Pulsar	2	3	3	4	3	3	1	5	4	4	
Up and Up	4	5	4	2	2	4	1	1	3	2	
											Sum
Sensitivity Rank	5%	12%	30%	10%	10%	5%	3%	8%	2%	15%	
GUM	0.1	0.48	0.9	0.2	0.4	0.15	0.03	0.3	0.1	0.6	3.26
Colgate 360 Optic White	0.2	0.36	1.5	0.4	0.3	0.25	0.03	0.225	0.08	0.45	3.795
Oral B type 3744	0.1	0.36	1.2	0.5	0.4	0.2	0.15	0.15	0.06	0.3	3.42
Arm and Hammer Spin Brush	0.1	0.36	1.2	0.3	0.4	0.15	0.03	0.225	0.04	0.45	3.255
Colgate NAEGMBDOPBAG	0.15	0.24	1.2	0.3	0.2	0.15	0.03	0.375	0.06	0.75	3.455
Oral B Pulsar	0.1	0.36	0.9	0.4	0.3	0.15	0.03	0.375	0.08	0.6	3.295
Up and Up	0.2	0.6	1.2	0.2	0.2	0.2	0.03	0.075	0.06	0.3	3.065











Looking back at the benchmarking information with the weighted hierarchy of needs obtained from the customer, we created a list of the best brush so far to understand what qualities create the best brush.

# Customer Needs Analysis

Our rank of the original toothbrushes is as follows:

1. Colgate 360 Optic White
2. Colgate NAEGMBDOPBAG
3. Oral B type 3744
4. Oral B Pulsar
5. GUM
6. Arm and Hammer Spin Brush
7. Up and Up

Author: \_\_\_\_\_  
Date: \_\_\_\_\_  
Notes: \_\_\_\_\_  
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Strong Relationship

Moderate Relationship

Weak Relationship

Strong Positive Correlation

Positive Correlation

Negative Correlation

Strong Negative Correlation

Objective Is To Minimize

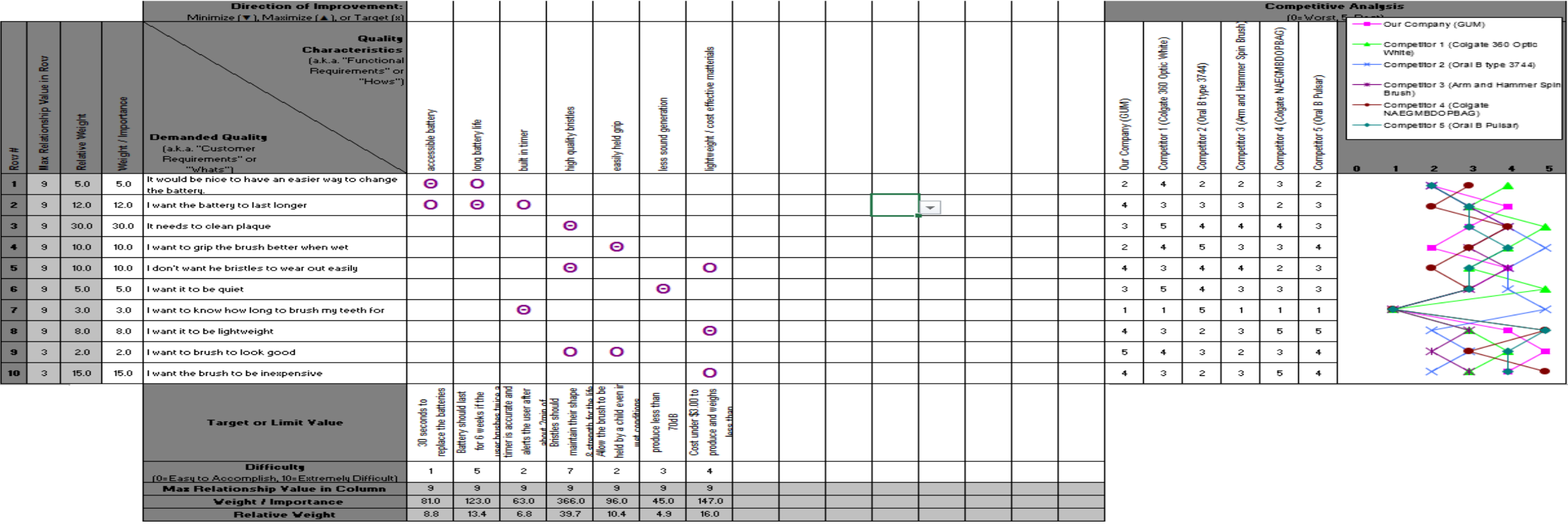
Objective Is To Maximize

Objective Is To Hit Target

9

3

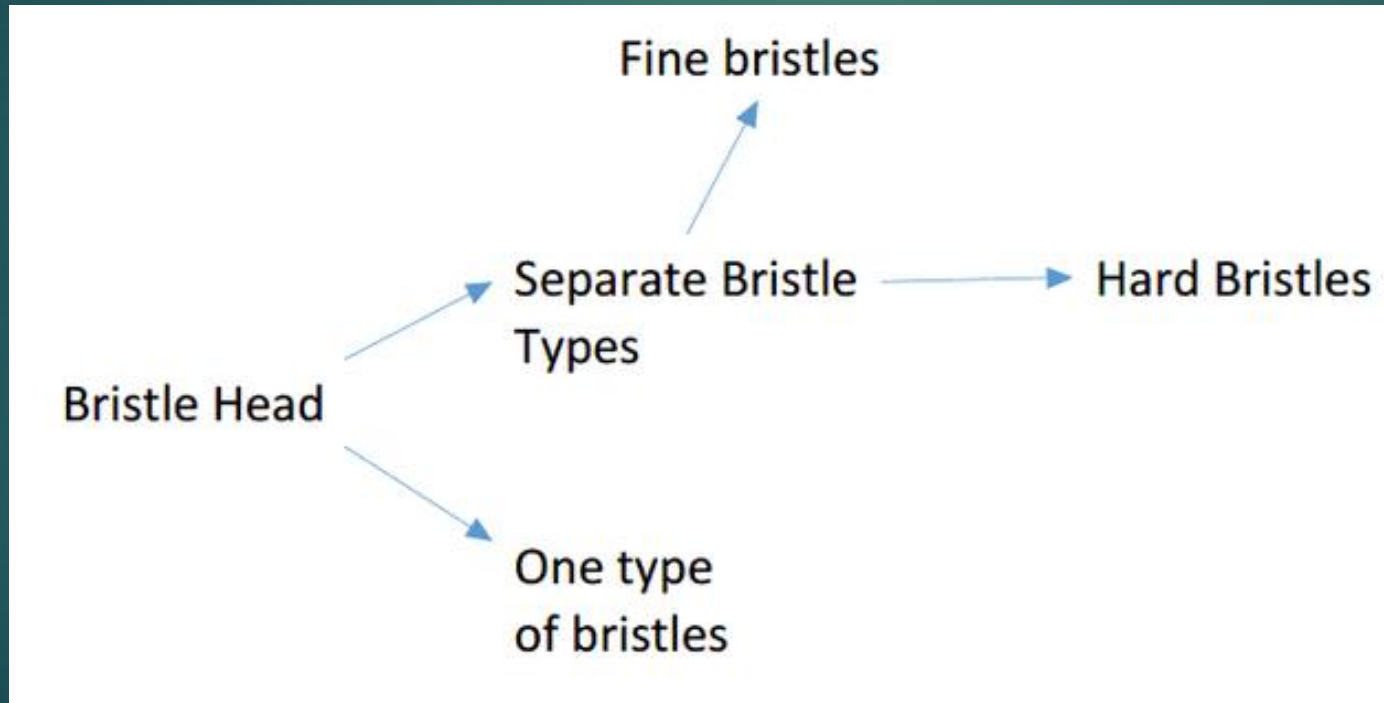
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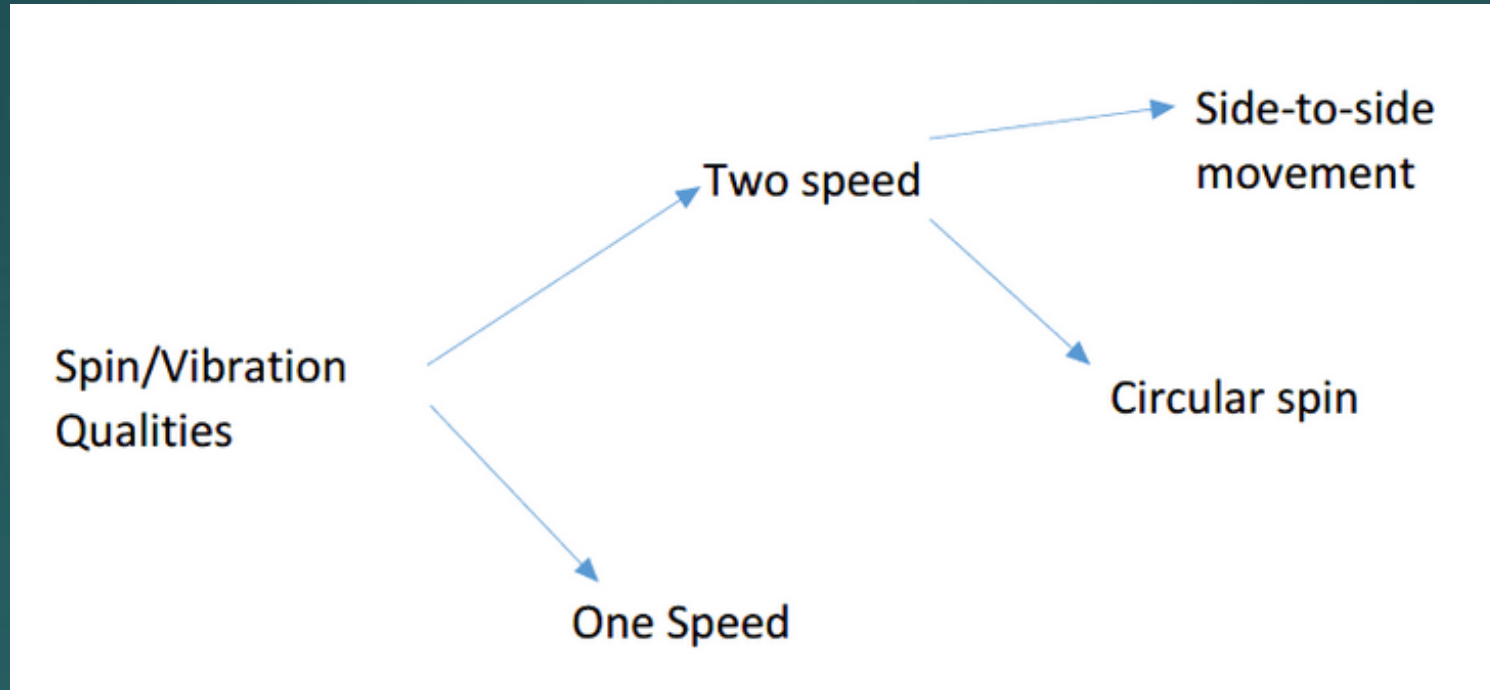
# House of Quality

# Concept Generation

Since we now have decided what qualities make the best toothbrush, we decided to lay out all of our ideas graphically to mix and match the best qualities of the redesign.

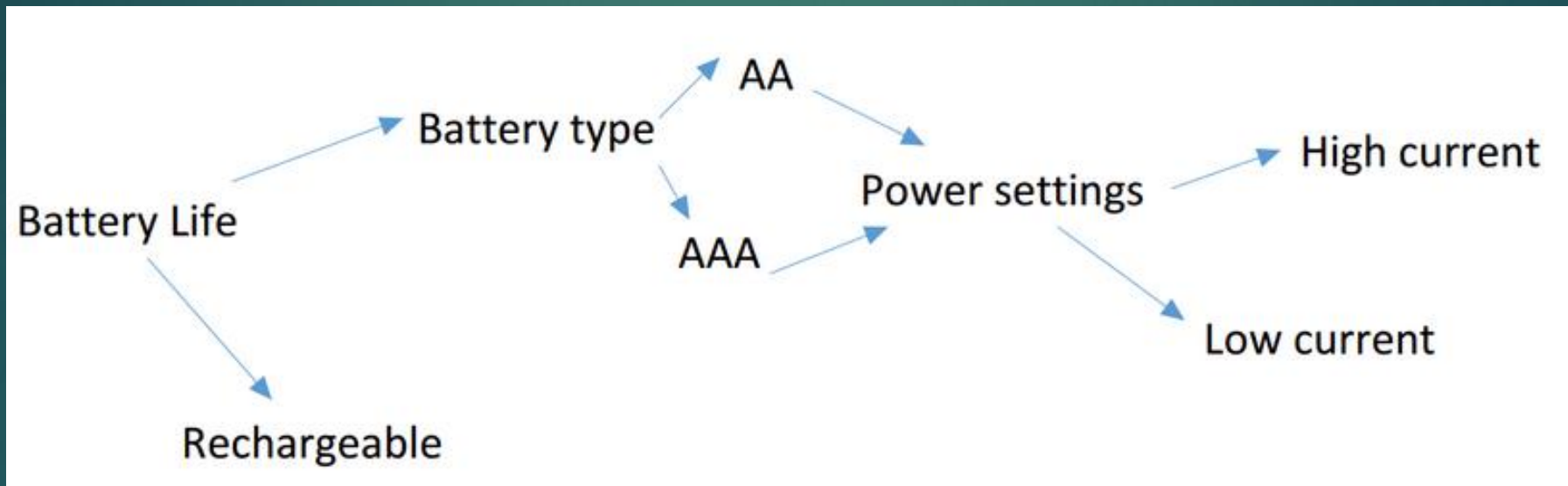


# Concept Generation

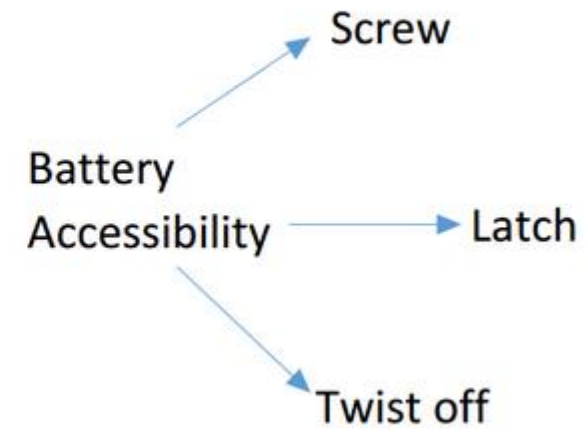
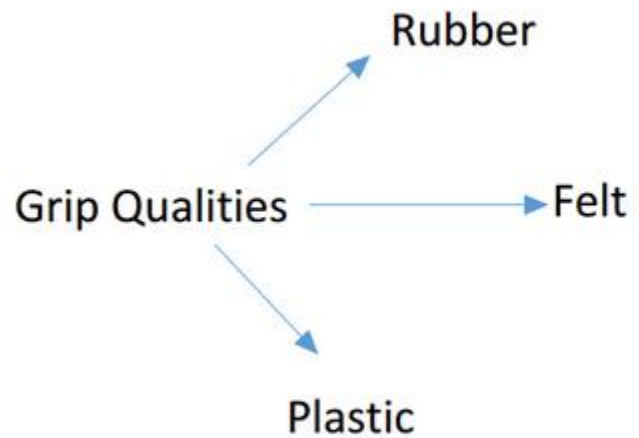




# Concept Generation



# Concept Generation



# Concept Selection

Overview: Since we decided that the effectiveness of cleaning plaque while maintaining a long battery life and a low cost to consumer, these will be the three main points for selection a new toothbrush. The other points will still be a factor, just not weighted to the same degree.

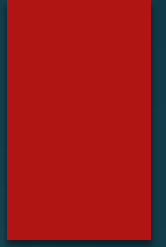
## **Bristle Head**

Things to consider in redesign:

- Are there different types of bristles on the head? Hard vs. soft? Fine vs. large?
- Is the head replaceable?

The ideal bristle head can efficiently clean, is durable and can be replaced. Looking at customer needs and our sensitivity chart, the bristle head is the most crucial part of the toothbrush. If the toothbrush does not clean plaque efficiently then it will not sell on the market.

# Concept Selection



## Spin/Vibration Qualities

Things to consider in redesign:

- Do certain bristles move at different speed?
- Do bristles vary in direction?
  - Side-to-side? Oscillating? Circular?

For optimal cleaning, the different bristles should move in certain directions. For instance, the heavy bristles could oscillate and the fine bristles could move in a circular motion. A combination of the two speeds and directions would allow for the best cleaning.

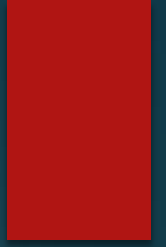
## Battery Life

Things to consider in redesign:

- Are the batteries rechargeable or replaceable?
- What type of batteries
  - AA or AAA?
  - How is the current through the toothbrush?

For our redesign, obviously we would like to make our battery last as long as possible. Changing from AAA to AA could prove useful, as AA provides more power. The current through the AA battery is greater than the AAA, which leads to a higher power.

# Concept Selection



## Grip Qualities

- What material is used for the grip?
  - Rubber?
  - Plastic?
  - Felt?
  - Combination of three?

Grip is important when the toothbrush becomes wet. We want to minimize how slippery the brush will become when affected by water. A combination of the materials would work the best in the redesign. The bigger the brush, the more rubber will be needed to allow for extra support. Felt really isn't necessary, but would look cool.

## Battery Accessibility

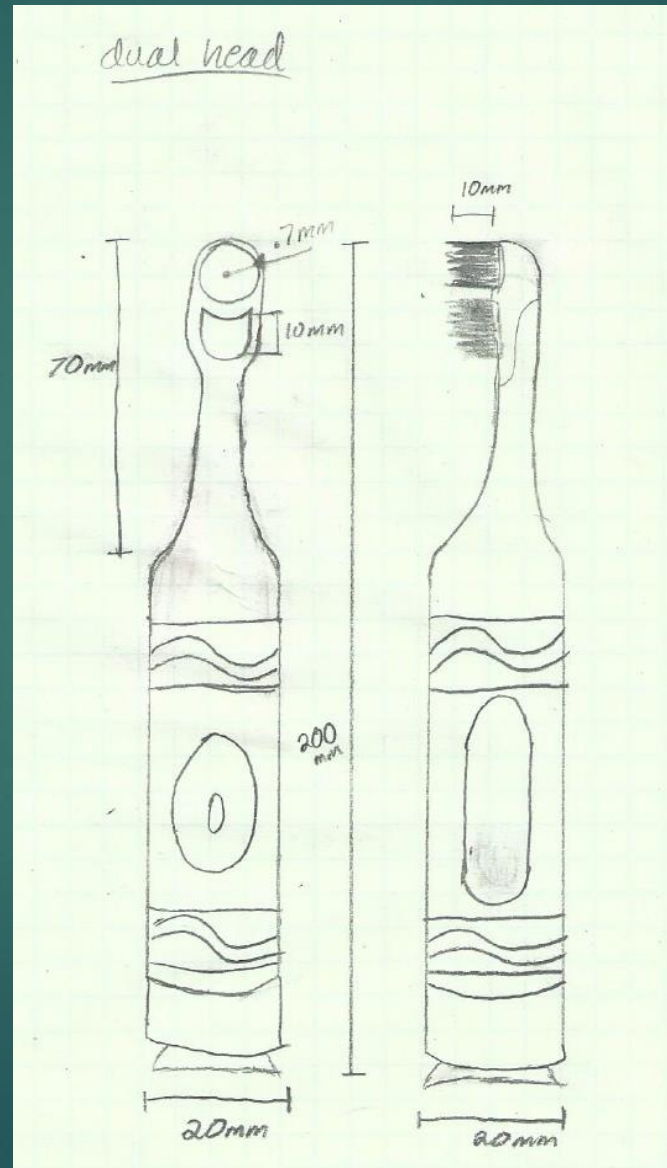
- How do you access the battery compartment?
  - Unscrewing?
  - Using a latch
  - Twist off

The most important things to consider when accessing the battery is how long does it take and does it close water-tight. A latch would most likely be the fastest way to access the batteries and as long as it keeps water out of the batteries it can be utilized.



# Concept Selection

## Dual Head Brush

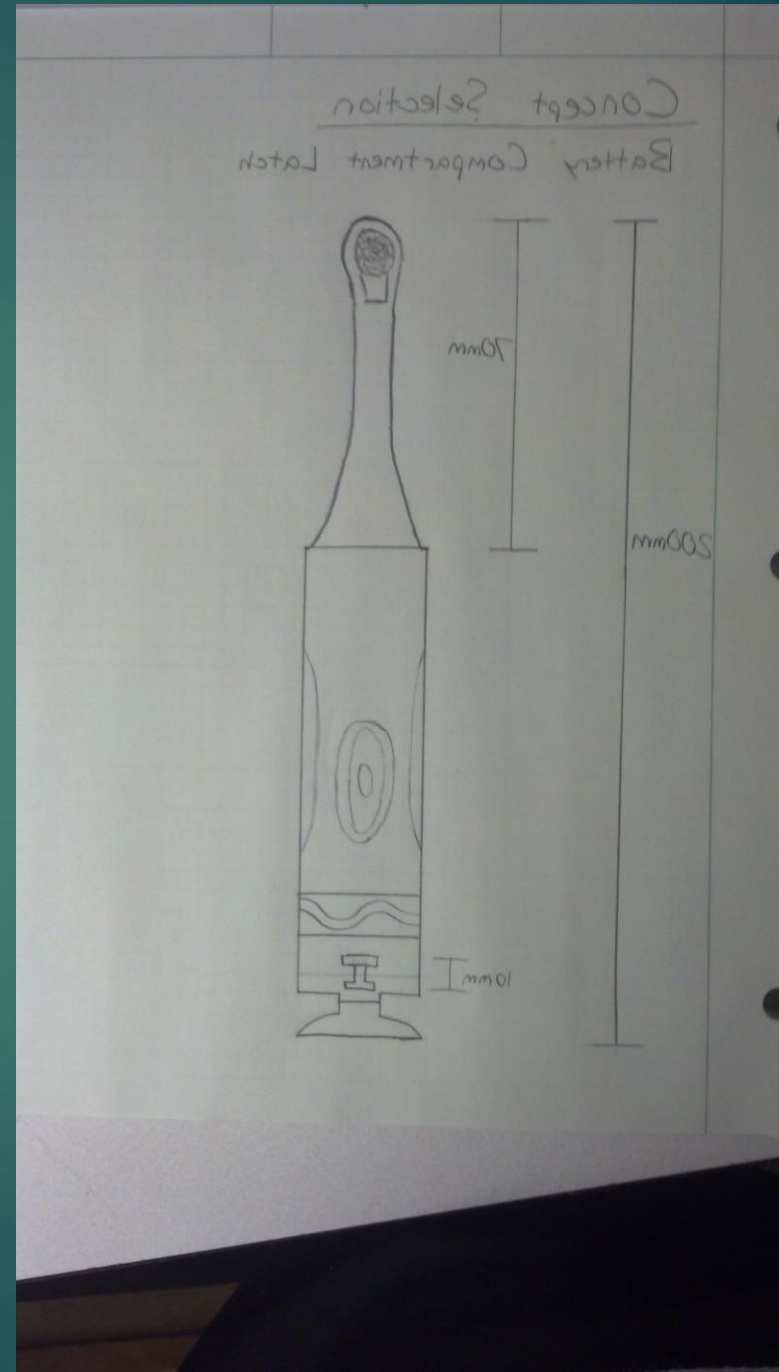


The toothbrush head contains two sets of bristles to help clean efficiently, one set that oscillates and the other that circulates. It also includes a detachable and replaceable head.

# Concept Selection

Open latch brush

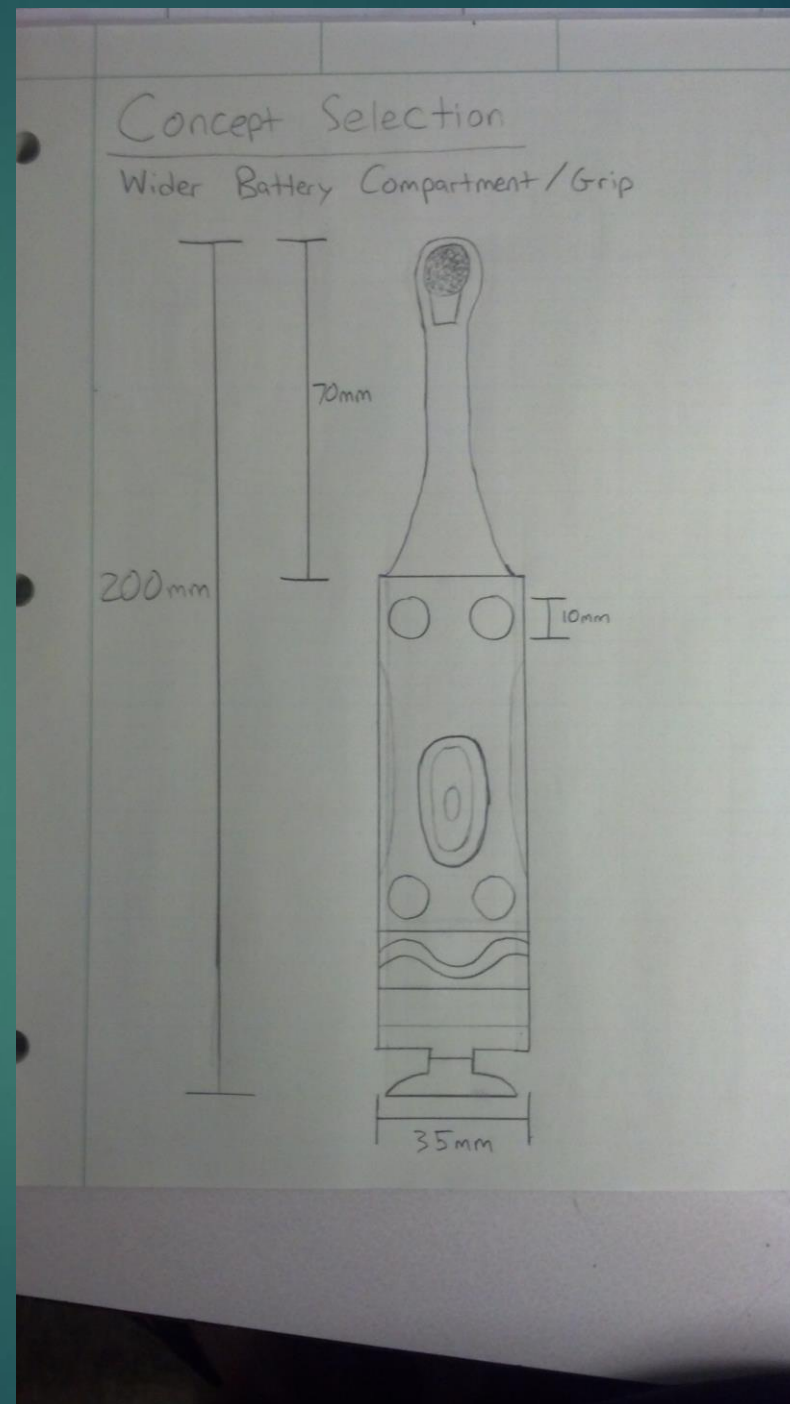
To make batteries more accessible for the consumer, a latch on the side of the handle will allow for quick access to the batteries.



# Concept Selection

Greater battery life with better grip

The toothbrush uses AA batteries instead of AAA which means the batteries will last much longer. The shaft will have to be bigger to hold the batteries, so a more comfortable grip was designed.



After the redesigns are complete, we will view their qualities in the same chart as we viewed the original toothbrushes.

[illegible]

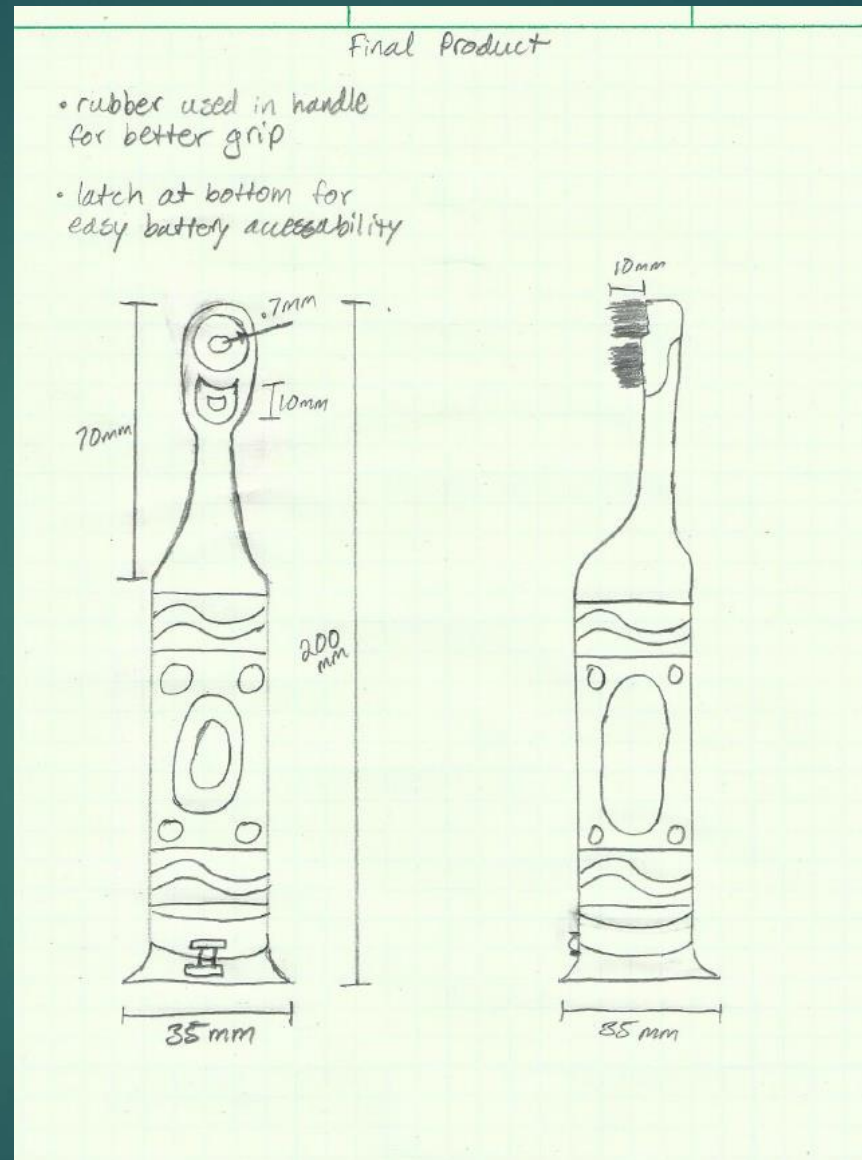
Now lets see the same chart with the weighted comparisons from the hierarchal needs we found from our consumers.

[illegible]



# Conclusion

The final design of our toothbrush includes all the features that we think are best to include in a toothbrush.



# References

1. "G-U-M Crayola Power Toothbrush" Drug Store.com, Oct. 7, 2013  
<<http://www.drugstore.com/products/prod.asp?pid=393593&catid=183794&aid=338666&param=37784725944brandG-U-M&device=c&network=g&matchtype=>>>.
2. "Electric Toothbrush" Wikipedia, the Free Encyclopedia. October 12, 2013.  
<[http://en.wikipedia.org/wiki/Electric\\_toothbrush](http://en.wikipedia.org/wiki/Electric_toothbrush)>.
3. "Electric Toothbrush- **US 6178579 B1**" Google Patents. Filed August 25, 1998. Issued January 30, 2001. <<http://www.google.ee/patents/US6178579>>.
4. "Electric Toothbrush- **US 6178579 B1**" Google Patents. Filed September 30, 1998. Issued December 14, 1999.  
<<https://www.google.ee/patents/US6000083?dq=US+6000083+A&hl=en&sa=X&ei=yi1IUtiDIuLD4AOT6lCwDQ&ved=0CDgQ6AEwAA> >.