

Should Skullcandy Introduce True Wireless Headphones?



Zachary Cavazos, Justin Lee, Jack Marshall,

Samir Shah, Leila Syal

BACKGROUND INFORMATION

Founded in 2003, Skullcandy is an American consumer electronics company based in Park City Utah that produces portable audio solutions. Skullcandy, well known in the underground punk scene, produces products that target the outdoor action sports demographics, primarily skateboarding, snowboarding and surfing, but also the general consumer market. Their best products include their in-ear Sweat Resistant Sport Earbuds, Ink'd 2.0 Earbuds, and Smokin' 2 Earbuds. In line with this target demographic, Skullcandy sponsors numerous up-and-coming artists and some of the top action sports athletes, including rapper Ivy Sole, NBA star Kyrie Irving, and Olympic Gold Medalist Mark McMorris.

The mastermind behind Skullcandy is Rick Alden, a non-conforming action sports enthusiast who birthed the idea of his product line on the slopes of Park City Peaks. Perhaps one of his greatest ideas was the technology to seamlessly switch from listening to music to talking on the phone. Alden patented LINK in 2003 which is a personal portable integrator for a music player and mobile phones (Smart device that links phone and music player with the ability to override music when you get a call), and thus conceived Skullcandy. In 2008, Skullcandy was named "The World's Coolest Earbud" by Fortune Magazine, and it has won numerous other creativity and design awards since its conception.

Currently, Skullcandy produces both headphones and earbuds. Their headphone line consists of over ear speakers connected by a band that sits on the top of the head. They connect to the phone with both a wire and bluetooth features. Their current earbuds consist of two in-ear speakers, that connect to the phone via a long single wire that splits into two, and a bluetooth version with a single wire connecting the two speakers together. The newest craze in personal audio solutions are true wireless earbuds, which consist of two separate in-ear speakers with bluetooth connection. Apple led the movement of these true wireless earbuds with the release of the Apple AirPods in December 2016. Skullcandy has hired marketing consultants from the Ross School of Business and College of Engineering to determine if it is feasible to produce a true wireless set of earbuds.

PROBLEM DEFINITION

Skullcandy is looking to expand its product line to include a true wireless earbud, and is trying to determine whether this line extension makes sense. If so, it wants to determine what features its customer base would like in a product placed at a higher price point than its existing earphone products. It should be in line with its current target demographic and market space, primarily action sports, and the general consumer market, as well as maintaining their brand of rebel punk.

In order for Skullcandy to move forward with its new product launch, we must first consider what features should be included, the ways in which it will be used, and our likely customers. Below are nine research questions that we identified to support our decision problem:

1. How many people use the headphones that come with their phone?
2. How long do people keep their headphones?
3. Do people prefer wired, wireless, or true wireless headphones?
4. How important is sound quality? (clarity and level of treble and bass in headphones)
5. Do people want fitness features? (heart rate, temperature, GPS, etc)
6. How important is water protection?
7. Does the shape of the earbud affect the decision to buy a pair of headphones?
8. Is there a demand for smart features? (i.e. Alexa compatibility)
9. How much are people willing to pay for those features?

SECONDARY RESEARCH

The global headphone market is expected to grow at a CAGR of ~7% from 2018-2023. As one of the top five headphone brands, Skullcandy is poised to increase its profits in the expanding market. With the earbud segment expected to grow at a CAGR of 30%, Skullcandy can best capitalize by offering a new product in the sector.

PRODUCT

The headphone market is split across multiple styles including in-ear or earbuds (earphones), and on-ear or over-ear (headphones), with each of these split into wired and wireless (bluetooth) configurations. We define earphones as speaker units that sit within the ear and headphones as speakers with cups that sit on or over the ear, connected by a headband. Emerging among the wireless styles has been the “earpod,” which has been defined in the Decision Problem section. This is a style that was popularized by Apple’s “AirPod” product and is now gaining popularity among customers looking for a true wireless headphone experience.

From one study in Statista, the most owned headphone styles are over-ear and earbuds, with 49% of respondents indicating ownership for each of these styles. From another study, wired headphones currently lead the global market with a 59% share against a 41% share for wireless headphones, however this is projected to flip over the next couple years. According to the same study, smart headphones are projected to follow a similar trend as more manufacturers are integrating these smart features.

At the current state, a standard feature across all styles is a microphone and buttons for pause and play actions. Additional actions of the buttons include answer or hang up phone calls, move to next song, or move to previous song. These functions enable phone calls and device free actions. Smart features that are now being incorporated into headphones include voice control and fitness features. Voice controls give the user a

hands-free experience with the ability to play certain music, make calls, add to lists such as shopping or to-do lists, among other standard voice control features. Fitness capabilities then include options such as heart-rate monitoring, gps and altimeter capabilities, and even workout coaching. According to one source, the sport headphone segment is the fastest growing segment in an otherwise largely stagnant market, especially in areas such as North America and Western Europe.

There are additional product features that will be considered in these studies, including quality of sound, which is often broken down into sound accuracy and general enjoyability. The latter is a subjective measure, however it is often judged as one of three common sound profiles among bass-heavy, v-shaped, and flat. Aside from sound, which is a feature in all headphones, a common premium feature is noise canceling, which can be active or passive. Passive noise canceling is a function of the headphones' seal in or over your ear to block out noise. Active noise canceling, on the other hand, uses a technology to actively block out outside noise. This is the most premium noise canceling feature that is only included on some of the most expensive products in the market. Within active noise canceling features are premium capabilities such as "Monitor Mode" that allow you to hear selective noises or hold conversations without having to remove the headphones or turn off noise canceling.

PROMOTIONS

Skullcandy is currently offering three promotions on its website: Buy two, get 20% off; general sale discounts; and an offer for a free Android phone with purchase. The "Buy 2, Get 20% off" off applies to the Smokin' Buds 2 and Strum earphone products, and customers are allowed to mix and match between the two products. General sale discounts are currently available for two headphone and two earphone products and range from 30% to 55%. Skullcandy also offers a free Android phone with the purchase of earphone or headphone products, provided the customer pay \$50 for the first month of service and enroll in autopay. Retailers may offer other promotions, features, and displays.

PRICE

Skullcandy offers both wired and wireless earphones and headphones; price ranges are detailed in Appendix B.1.

PLACEMENT

Skullcandy's currently offers their products through two major channels: online and retail. Skullcandy has its own website store, and also distributes through online retailers like Amazon.com. Its products are placed in electronic retailers like BestBuy, outdoors retailers like REI, and independent action sports shops. The retailers may also offer Skullcandy products in their own online stores.

Customer, Company, Competitors: Does It Make Sense?

Skullcandy's target customers generally include younger people who cannot afford fancier headphones, people who want a colorful set of headphones, and - more generally - the skateboarder, surfer, rebel demographic. These customers often cannot afford the current true wireless earbuds on the market; given Skullcandy's reputation as a trusted brand with lower costs, which may be a barrier Skullcandy needs to overcome in pricing its product.

Skullcandy already produces wireless headphones - both over-ear and earbuds. The current earbuds, however, are connected by a cord; Skullcandy does not currently make true wireless earbuds. Its primary target market may be fruitful, as many skateboarders and surfers live active lifestyles and could use a flexible alternative to Skullcandy's current set of earbuds. If Skullcandy makes an affordable product that can withstand swift movements without tangled wires getting in the way, this demographic would likely be receptive to trying out the product.

Many of Skullcandy's competitors - including JVC, Bose, and Sony - already make true wireless headphones, for both daily and athletic use, and are typically priced at over \$100 (the lowest pair available on Best Buy's website sells for \$80) (Best Buy, [True Wireless Headphones](#), accessed 10/5/2018). Skullcandy competes on price and style with other headphone brands and could do so in this category, especially given the high price point for most true wireless earbuds and the fact that many Skullcandy companies do not yet own true wireless earbuds.

DATA ANALYSIS

METHODOLOGY

Crosstabs

Crosstabs and T-test were performed on 14 combinations of variables from our survey. We originally made these combinations based off the following variables: Income, brand, ownership time, gender, time listened to per day, age, connection style, and earfit. To run the tests we used a One-way Anova or Chi-Square for each of the combination depending on whether they were a continuous or discrete variable. Depending on the significance from these tests, we went through the different answers and found the significance value for each, along with the corresponding crosstab.

Originally we found that there was no significance with any of the combinations used, so we met with our professor to change our approach. To find better significance, we first assigned numbers to new variables so that the distribution would be more even. These new variables were created for listening time and time owned, and

the variables were split into a low score and high score thus giving us more users in each group making a more significant trend.

The crosstabs and T-test allow Skullcandy to determine which combination of variables show significance, allowing them to target specific groups for specific products. Appendix C shows our crosstabs and T-test results for our significance test.

Conjoint

We used SPSS to build conjoint variables, and ran the survey using Qualtrics. We created a baseline of wired earphones with no health features at \$19.99. This left six variables among the four categories: Connection type (wireless or true wireless), Earfit (earbud), Health Features Via App (yes), and Price (\$99.99, or 199.99). Then the partworths for each of the variables were found and those were used to determine people's willingness to pay for each feature. From this information we were able to verify our recommendations.

Factor Analysis

Factor analysis was performed on two sets of independent variables: first psychographics and lifestyle, then importance of various features. The factors were then used to in a regression of willingness to pay from the conjoint analysis.

The first set of variables used to perform the factor analysis were from questions asking about respondent behaviors and psychographics, questions 11 and 12, in the survey (Appendix C). The responses from these questions were used to build lifestyle factors. The second set of data used to create factors were data from responses to question 10, which asked about the importance of various features. This produced the feature importance factors.

These factors were then used as independent variables to perform linear regressions with partworth results from the conjoint analysis. This enables Skullcandy to determine how much potential customers care about connection type, earfit, and health features relative to each other based on their interests and fit with the calculated factors.

Cluster Analysis

A cluster analysis was performed on the four categories from our conjoint survey. This was performed twice, first creating three clusters then with four clusters. The cluster analysis utilized the K-Means technique to iterate and find clusters.

The four categories used as variables were derived from our analysis of the conjoint survey, question 13. These variables were standardized to be used in cluster analysis. Due to our knowledge of our factor analysis, we began with three clusters, however, then moved to four clusters to understand our data at a deeper level.

The cluster analysis allows Skullcandy to understand who the respondents to the survey are. This enables Skullcandy to prioritize what features are important to each of their customer groups.

RESULTS

Crosstabs

We performed 14 crosstabs and found that the only pair of variables that had significance were gender and time spent listening, however this was after we changed our alpha from 0.05 to 0.1. Although most weren't significant, there were 3 others that were very close, including income bracket vs. brand, time owned vs. gender, and time owned vs. headphone brand. We found it interesting that none of these comparisons came back with more significant results, and noted that our sample size for our survey was made of only graduate students, mainly MBA with some SI and Engineering students.

At first we assumed that all the students had the same demographics as far as age, income, and education. After closer considerations we ended up not using the income data because of the inconsistencies from responses, as some people were inputting incomes of what they were currently making as a student, while other placed incomes of what they were making with their jobs after their MBAs. With these extremes the results for the crosstabs with income were not valid, which makes sense because income was not significantly correlated with any of the buying segment factors.

The only crosstabs that were showing significance were gender and time spent listening, which makes sense because these were the only questions we asked that would have an even distribution. Overall we found that on average men listen to more music (Fig. C.2.3).

Conjoint

During our analysis, we found the partworths for each of the 4 categories. When looking at the average connection partworths, wireless had the highest partworth score, followed by true wireless and wired which made sense because wired headphones are less desirable and true wireless aren't as popular.

We next looked at the average earfit, where an earphone is the type of fit that creates the seal, and earbud is the type that sits on the ear but doesn't make a seal. Here the partworth for earphones were higher, possibly because

they provide a seal which is somewhat sound proof, and gives a better bass. For the average health feature section, we found the partworth for having the health features to be much higher, and thus people would pay for headphones that have these features.

Lastly, when looking at the price partworth we noticed a dip as the price goes up, with \$19.99 being the highest followed by \$199.99 then followed by \$99.99. We assume this is because our users know the quality associated with each level, a standard \$19.99 is desirable for a cheap solution, and when users want to get a high end headphone they'll spend up to \$199.99. Thus the \$99.99 option being our midtier headphone is least desirable, which will help explain our recommendations.

Factor Analysis

The Scree plot showed that three factors would be important (Fig. B2.1). Using the variables with the highest correlations with the factors, they were identified as Routine-Based Homebody, Traditional Fitness, and Media Pioneer (Table B2.1). The Routine-Based Homebody has their routines and preferences, and are not looking for new things. Traditional Fitness likes working out and to be outdoors, and the Media Pioneer enjoys entertainment and finding new music.

The feature importance Scree plot (Fig B2.2) did not have as clear of a distinction of how many factors would be important, so a threshold of 1 was used; this produced four factors. These were identified as Traditional Fitness, Productivity, Media Consumer, and Value Oriented (Table B2.2). Traditional Fitness rated high importance for waterproofness and Health data; Productivity rated microphone quality brand, and assistant compatibility as highly important; the Media Consumer rated sound quality and noise cancellation as highly important; and Value Oriented prioritized price and wireless connection.

Both sets of factors were used in a linear regression with partworth results for Wireless connection, True Wireless connection, Present health data, and Earphone for earfit from the conjoint analysis. Of the 8 regressions performed – two for each partworth – a significant relationship was found for three partworths: Earphone, Wireless, and True Wireless. The Traditional Fitness factor from the lifestyle analysis was found to be significant for Earfit, and the Traditional Fitness factor from the feature importance analysis was found to be significant for Wireless and True Wireless connections. No other factors were found to be significant.

Cluster Analysis

The cluster analysis with three clusters helped us to confirm our results from our lifestyle factor analysis. Table B3.1 shows the final cluster centers with Table B3.2 shows the ANOVA table. Our first cluster reminded our group of our “Traditional Fitness” persona since EarFit was the only positive value out of our six variables. The

comfort had been demonstrated to be important to our active group. The second cluster seemed to fit our “Routine-Based Homebody” as the health data and price were important. Our second group prefers the health app to make sure they are staying consistent with their routine, and they also are willing to spend more for headphones. This showed our group that our Routine-Based Homebody’s were willing to pay more and not have to change out their headphones often. Our last cluster fit our “Media Pioneer” as there was a strong importance placed on connection type (wireless or true wireless), the comfort of the earfit and they were willing to pay more for headphones. This depicted someone who wants the next best headphone and is willing to spend money to get the new, quality headphones.

Our group did the same K-Means but with four clusters. This analysis helped to explain the price valley that we saw in our average partworth graph. Cluster 4 from Table B3.3 has an importance rating for \$99.99 = -0.126 and the importance rating for \$199.99 = 0.377 with the baseline of \$19.99 = 0. This shows that this group of people will pay high amounts for premium headphones or low for budget headphones, but the middle range is not something they would do. Cluster 4 also had remnants of our “Routine-Based Homebody”. Cluster 1 became our “Media Pioneer”, cluster 2 became our “Traditional Fitness” and our third cluster became our “Brand Conscious” buyer as they don’t care about earfit but they care about connection, they are willing to pay higher prices and want the health app features. They like to have the latest brands for the sake of having it and less for the love of the technology like our “Media Pioneer”.

KEY FINDINGS

The first set of questions on our survey were aimed at the first three research questions. These summary graphs can be seen in Appendix C. Figure C.1.1 show that 60.5% of our respondents use the headphones that come with their phone. 37.2% of respondents keep their headphones between 6 months and a year (Fig. C.1.5), while 39.5% prefer having a headset that forms a seal in their ear canal (Fig. C.1.6). They tend to spend 1 - 2 hours a day using their headset (Fig. C.1.3) and are mostly using some type of Apple headphones (51.2%) (Fig. C.1.4).

From our rating questions we learned that sound quality was ranked as the most important attribute when buying headphones, closely followed by price. The next set of highly ranked attributes were Brand Name, Wired-Wireless, and Noise Cancellation. The survey then asked respondents about their lifestyle; respondents indicated most frequently that they used their headset when they were outdoors and when they exercised. The next most highly selected use cases for headsets were watching media on a personal device, while they work, while they commute, and when they talk on the phone. Having a waterproof rating was ranked in the middle of our set of attributes, indicating that it would be nice to have, but it isn't necessary to our respondents. Similarly, compatibility with a smart assistant was ranked lower, indicating that it is not that important.

From our conjoint analysis, we can determine that people are willing to pay more for wireless headphones over true wireless, but both of these options are preferable to wired headphones. People were more willing to pay for earphones rather than earbuds or headphones, and they also would pay more for health features tied to an app. The anomaly was the price partworth. There was a valley for the \$99.99 price point; this was interpreted as people are willing to either pay a small amount for budget headsets or a large amount for a premium brand. This was preferred over a middle ground for both price and quality. The median willingness to pay for wireless headphones was \$126.32, and true wireless was \$61.64. Our respondents had a median willingness to pay of \$41.47 for earphones over earbuds, and a willingness to pay for health features of only \$29.46.

From the factor and cluster analysis, our group validated that respondents answered consistently to the lifestyle and conjoint questions, as the lifestyle factor analysis and the cluster analysis found the same number of factors. We also were able to confirm from the cluster analysis the price valley that we found in the conjoint analysis. We created three personas: “Routine-Based Homebody” who cares about health features and not about sound quality; “Media Pioneer” who is passionate about wireless, true wireless, sound quality and is willing to pay more for better headphones, is always on the hunt for the next new thing. Finally, the “Traditional Fitness” individual is not worried about most quality features except for earfit, as they want comfort when they are moving.

RECOMMENDATIONS

From our findings, we flatly recommend that Skullcandy does not pursue a true wireless headphone at this time. As a company, Skullcandy has positioned itself as a budget-friendly, affordable brand, marketed towards the often low-income outdoor action sports enthusiasts. These customers are not likely to be able to afford a more expensive set of true wireless headphones. Additionally, our research suggests that there is a price “valley” between budget headphone pricing and premium headphone pricing that represents the consumer’s unwillingness to pay for a middle-market true wireless headphone, but rather take on a lower price point for similar quality and features, or pay a much higher premium price for a significant upgrade. Based on Skullcandy’s current position and pricing on wireless headphones (~\$50), we believe Skullcandy’s headphones would fall into this middle ground for a true wireless product (~\$75 - \$90), which likely would not gain traction in the competitive headphone market.

Our conjoint results indicate that wireless headphones are still the preferred headphone connection, over both true wireless and wired headphones. Skullcandy is in a good position to maintain its current offerings and pricing in a market where more and more consumers are transitioning from wired to wireless headphones and where the earbud market continues to grow.

LIMITATIONS OF RESEARCH

Like many groups, our primary limitation was a lack of demographic diversity. Most of the respondents to our survey were Marketing 618 students. As a result, nearly every respondent had the same education level, approximate age, and income. Our team at times had trouble in finding significant results in our survey data - especially when looking at demographic data - and lack of diversity may have been a contributing factor. With a wider response pool, our team would have been able to learn more about Skullcandy's potential customers.

Although our team wrote our survey to learn about what qualities people look for in headphones, we were not able to gather information on some traits. Many headphone purchasers make their decisions based on packaging, fit, and overall aesthetics. These traits are mostly visual and are difficult to describe in a survey without letting the potential customer see them in person. While we were able to gather information about other desired qualities in headphones, design is a vital aspect that was difficult to glean from a written survey. Given Skullcandy's reputation of appealing to the rebel, outdoor action sport demographic - as well as its flashy packaging and colorful headphones - design is a crucial aspect of its brand. We therefore would advise Skullcandy to supplement this survey with focus groups among its target customers in order to better understand their desired feel and look of headphones.

Skullcandy is known not only for its "rebel" brand and colorful designs, but also for its affordable budget prices. If the company were to introduce a pair of true wireless headphones, pricing would be of paramount importance. Our survey results, however, showed that calculating willingness to pay would not be possible with the current set of data. The conjoint analysis tested price points of \$19.99, \$99.99, and \$199.99; instead of the partworth going down in a straight line - or close to it - from the lowest to highest price point, the partworth at \$99.99 was significantly lower than that for the \$199.99 price point. If Skullcandy introduced the true wireless product line, this result is a significant limitation for arguably the most crucial of the four P's: pricing.

APPENDIX A: REFERENCES

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APPENDIX B

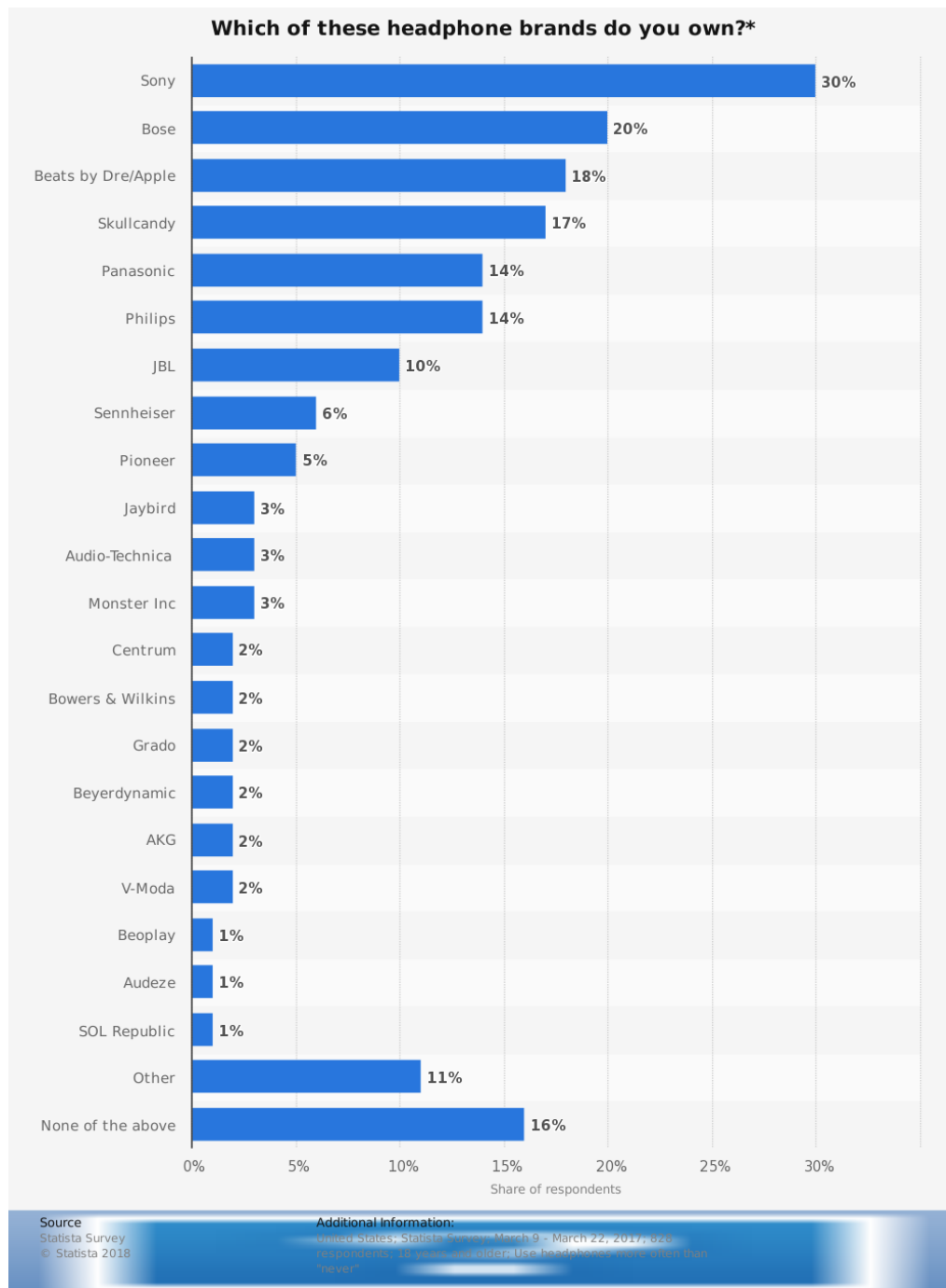
B.1 HEADSET PRICES

Table B.1.1 This displays Skullcandy's product price ranges for wired and wireless earphones and headphones. These prices are non-promotion, and were collected from Skullcandy's website.

	Wired	Wireless
Earphone	\$20 - \$50	\$35 - \$100
Headphone	\$20 - \$100	\$50 - \$300

B.2 MARKET SHARE

Figure B.2.1 (Statista survey)



APPENDIX C: DATA ANALYSIS

Appendix C.1: Survey Visuals

Figure C.1.1

Do you use the headset that comes with your phone?

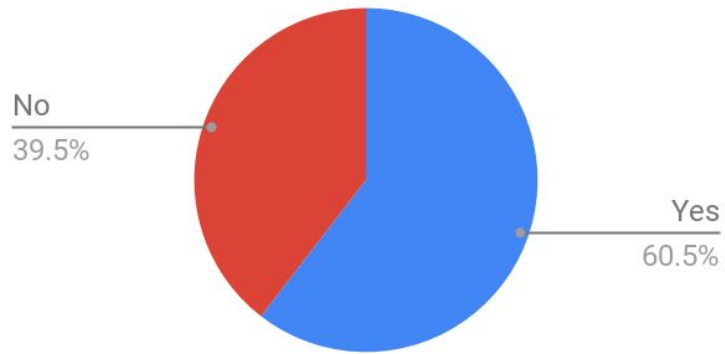


Figure C.1.2

How often do you use your headset?

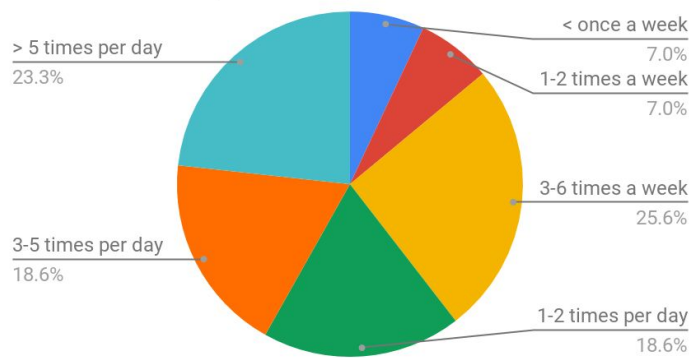


Figure C.1.3

How much time per day do you spend using your

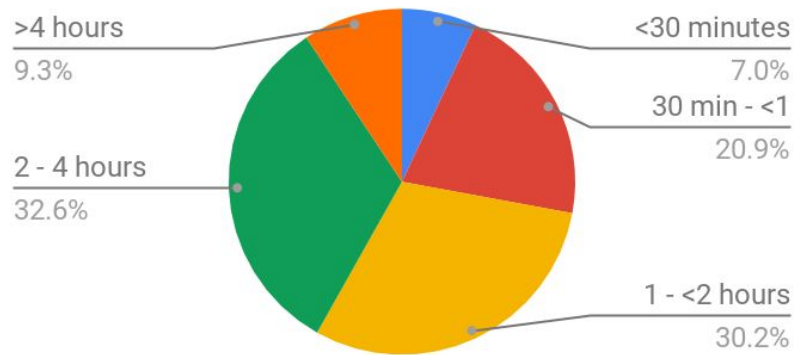


Figure C.1.4

What is your brand of your current primary headset?

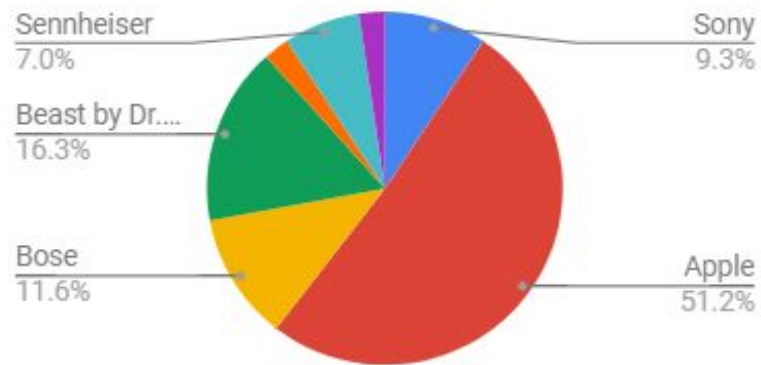


Figure C.1.5

How long have you owned your current headset?

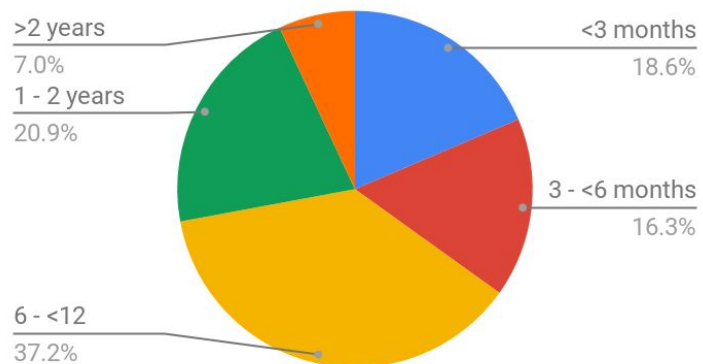
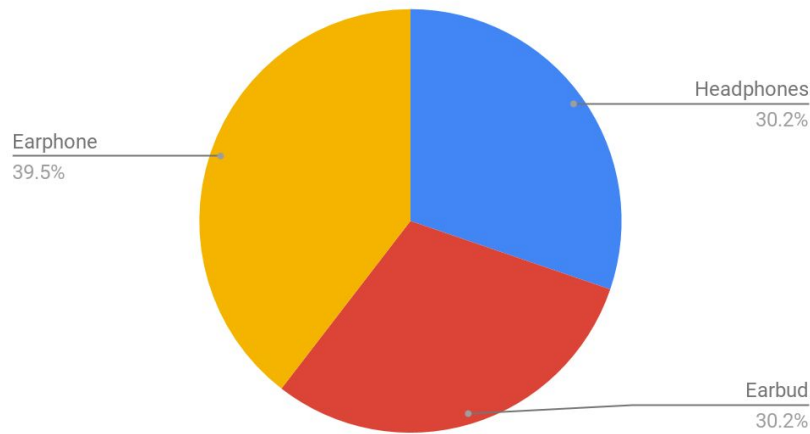


Figure C.1.6

What type of headset fit do you prefer?



Appendix C.2: Crosstabs

Below shows the crosstabs and T-test for our only significant comparisons, Gender vs. Listening Time.

Table C.2.1

New_Listening_Time * What gender do you identify as?
Crosstabulation

Count

		What gender do you identify as?		
		Male	Female	Total
New_Listening_Time	1.00	2	9	11
	2.00	15	17	32
Total		17	26	43

Table C.2.2

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
New_Listening_Time	Equal variances assumed	15.926	.000	1.696	41	.097	.22851	.13472	-.04357 .50059
	Equal variances not assumed			1.833	40.873	.074	.22851	.12466	-.02328 .48029

Table C.2.3

Group Statistics					
	What gender do you identify as?	N	Mean	Std. Deviation	Std. Error Mean
New_Listening_Time	Male	17	1.8824	.33211	.08055
	Female	26	1.6538	.48516	.09515

Appendix C.3: Conjoint

Table C.3.1

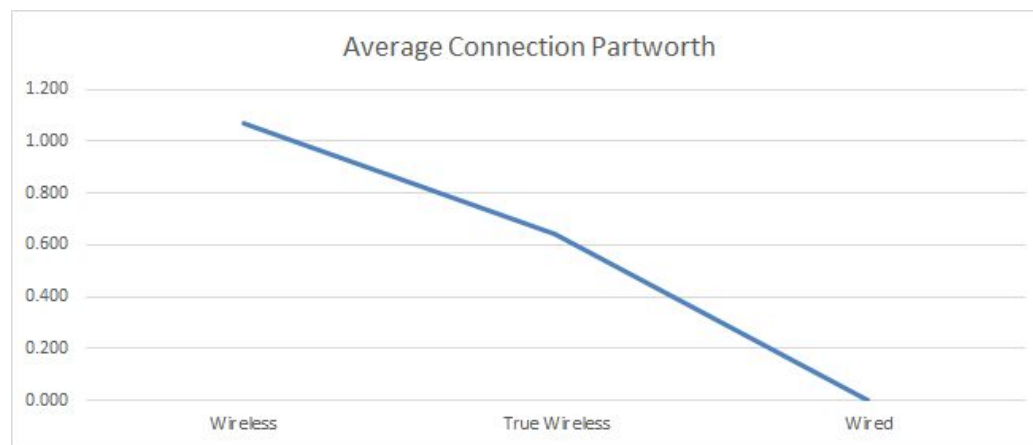


Table C.3.2

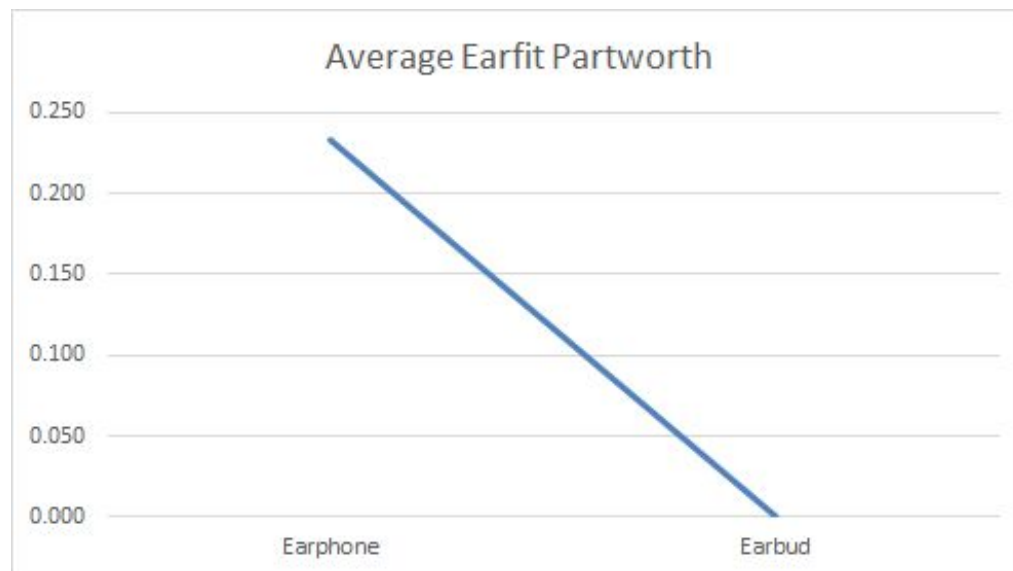


Table C.3.3

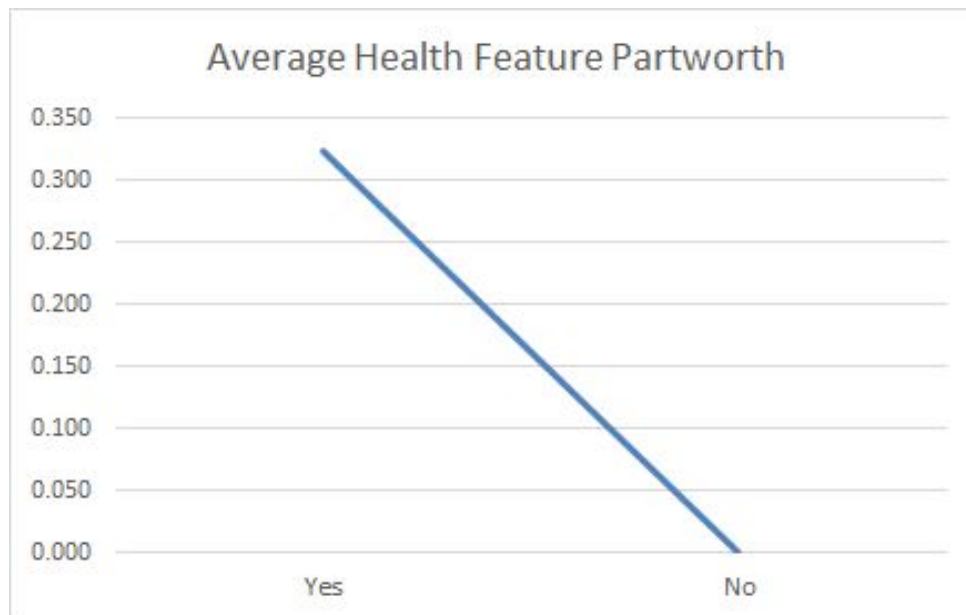


Table C.3.4



Appendix C.4: Factor Analysis

Lifestyle

Figure C2.1. The factor analysis of behavior and psychographic data produced this Scree plot. We decided that limiting the eigenvalue to three would likely produce meaningful results, as that is the point at which the Scree plot drops significantly and the remaining components have a much lower slope.

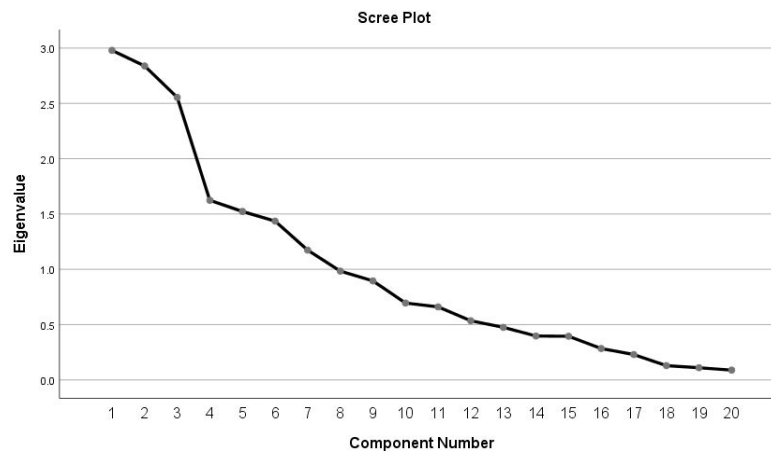


Table C2.1. The Rotated Component Matrix from the factor analysis performed using behavior and psychographic data collected from questions 11 and 12, respectively. The variables with greatest impact on the factors are highlighted in red, and were used to build a factor description.

	Routine-based Homebody	Traditional Fitness	Media Pioneer
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statement: I like to use a headset... - While I shower.	0.802	0.178	-0.288
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statement: I like to use a headset... - While I sleep.	0.802	0.294	-0.134
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statement: I like to use a headset... - While I eat.	0.683	-0.094	0.303
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statements? - I love only one genre of music.	0.608	-0.236	-0.36

On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statements? - I love gaming.	0.554	-0.128	0.222
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statement: I like to use a headset... - While I study.	0.314	-0.136	0.283
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statement: I like to use a headset... - While I watch movie on personal device.	0.308	0.173	0.198
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statements? - I love outdoor sports.	0.242	0.814	0.13
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statements? - I love hiking.	-0.107	0.721	-0.163
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statements? - I love fitness.	0.051	0.66	0.295
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statements? - I love to be by the water.	0.052	0.64	0.026
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statements? - I love to travel.	-0.343	0.436	-0.033
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statements? - I love to cook.	-0.26	0.292	-0.031
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statements? - I love entertainment.	-0.075	-0.164	0.812
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statement: I like to use a headset... - While I exercise.	-0.059	0.315	0.685
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statements? - I love finding new music.	-0.024	0.065	0.581
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how	0.211	-0.025	0.49

do you identify with the following statement: I like to use a headset... - While I work.			
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statement: I like to use a headset... - While I am outdoors.	0.076	-0.217	0.446
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statement: I like to use a headset... - While I commute.	-0.019	0.037	0.311
On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statement: I like to use a headset... - While I talk on the phone.	0.051	0.103	0.237

Attribute

Figure C2.2. The factor analysis of feature importance data produced this Scree plot. Because there is not a clear distinction of the number of important factors in the form of a kink, a threshold of >1 was used for the eigenvector, reducing the number of important factors to 4.

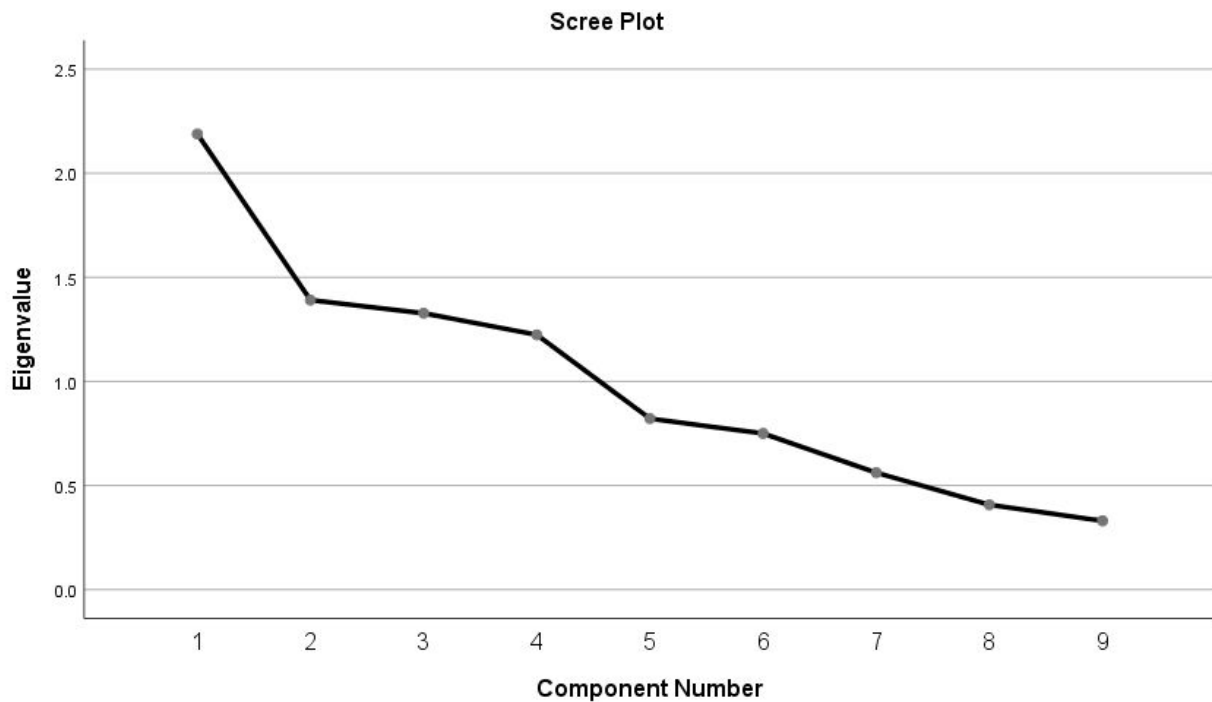


Table C2.2. The Rotated Component Matrix from the factor analysis performed using feature importance data collected from questions 10. The variables with greatest impact on the factors are highlighted in red, and were used to build a factor description.

	Traditional Fitness	Productivity	Media Consumer	Value Oriented
On a scale from 1 (least important) to 7 (most important), rate the following headphone attribute: - Waterproof	0.829	-0.025	0.033	0.188
On a scale from 1 (least important) to 7 (most important), rate the following headphone attribute: - Health Data via App	0.807	0.145	0.02	-0.082
On a scale from 1 (least important) to 7 (most important), rate the following headphone attribute: - Microphone Quality	0.075	0.805	0.045	-0.173
On a scale from 1 (least important) to 7 (most important), rate the following headphone attribute: - Brand Name	-0.07	0.696	0.058	0.425
On a scale from 1 (least important) to 7 (most important), rate the following headphone attribute: - Alexa/Siri/Google Assistant Compatible	0.467	0.526	-0.069	-0.114
On a scale from 1 (least important) to 7 (most important), rate the following headphone attribute: - Sound Quality	-0.224	0.08	0.851	-0.039
On a scale from 1 (least important) to 7 (most important), rate the following headphone attribute: - Noise Cancellation	0.316	-0.032	0.805	0.029
On a scale from 1 (least important) to 7 (most important), rate the following headphone attribute: - Price	-0.086	-0.038	-0.084	0.835
On a scale from 1 (least important) to 7 (most important), rate the following headphone attribute: - Wired or Wireless	0.455	-0.004	0.118	0.623

Appendix C.4: Cluster Analysis

Table C3.1

Final Cluster Centers			
	Cluster		
	1	2	3
Zscore(ConnectionA)	-.35885	-.66619	.77522
Zscore(ConnectionB)	-.28886	-.91841	.86286
Zscore(EarFit)	.07662	-.93113	.50534
Zscore(Health)	-.48717	.65247	.07938
Zscore(PriceA)	-.85178	.22304	.71238
Zscore(PriceB)	-.96029	.56240	.60878

Table C3.2

ANOVA						
	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
Zscore(ConnectionA)	8.057	2	.638	39	12.627	.000
Zscore(ConnectionB)	10.841	2	.495	39	21.887	.000
Zscore(EarFit)	6.425	2	.722	39	8.901	.001
Zscore(Health)	4.078	2	.842	39	4.842	.013
Zscore(PriceA)	10.113	2	.533	39	18.985	.000
Zscore(PriceB)	11.924	2	.440	39	27.111	.000

Table C.3.3

Final Cluster Centers

	Cluster			
	1	2	3	4
Zscore(ConnectionA)	1.25891	-.45803	.21836	-1.17999
Zscore(ConnectionB)	1.06081	-.32606	.13667	-1.04941
Zscore(EarFit)	.90981	.04148	-.07564	-1.31715
Zscore(Health)	-.49386	-.43577	.49797	.83427
Zscore(PriceA)	.22556	-.87030	.98184	-.12628
Zscore(PriceB)	.25812	-1.00665	.87622	.37699

Table C3.4

ANOVA

	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
Zscore(ConnectionA)	8.779	3	.386	38	22.751	.000
Zscore(ConnectionB)	6.185	3	.591	38	10.471	.000
Zscore(EarFit)	5.985	3	.606	38	9.868	.000
Zscore(Health)	4.065	3	.758	38	5.363	.004
Zscore(PriceA)	7.828	3	.461	38	16.981	.000
Zscore(PriceB)	8.622	3	.398	38	21.648	.000






APPENDIX D: SURVEY

This survey is being conducted to help Skullcandy design a new line of headphones. The survey will allow us to compare attributes of different headphones. In the table below we list the different types of headphones we are analyzing, please take a close look at the definitions of each type of headphone as they correspond to specific placement of the device on someone's ear, and whether the style of headphone comes in a wireless option. Please answer all questions honestly, as this information is critical in our design, and will be kept confidential.

The survey will take approximately 7-8 minutes. Thank you for your participation.

This table defines the different types of headphones that will be asked about in the survey.

Please be sure to note the distinctions.

Term	Picture	Placement	Wireless?
On/Over-ear		Sits on/around the ear	Can be wired or wireless
Earbud		Sits in ear	Wired or wireless
Earphone		Sits inside ear and creates a seal with the ear canal	Wired or wireless
Wireless		Sits in ear, may be a earphone or earbud	Wireless to device, has cord connecting earbuds/earphones together
True Wireless		Sits in ear, may be a earphone or earbud	Wireless, no cords at all

1) Do you use the headset that come with your phone?

☐ Yes ☐ No

2) How often do you use your headset?

☐ Less than once a week ☐ 1-2 times per week ☐ 3-6 times per week
☐ 1-2 times per day ☐ 3-5 times per day ☐ More than 5 times per day

3) On average, how much time per day do you spend using your headset?

- ☐ Less than 30 minutes ☐ 30 minutes - <1 hour ☐ 1 - <2 hours
☐ 2-4 hours ☐ Over 4 hours

4) What brand of headset have you used? (select all that apply)

- ☐ Sony ☐ Bose ☐ Beats by Dr. Dre
☐ Apple ☐ Skullcandy ☐ Panasonic
☐ JBL ☐ Sennheiser ☐ Other (please specify): _____

5) Currently, what is the brand of your primary headset?

- ☐ Sony ☐ Bose ☐ Beats by Dr. Dre
☐ Apple ☐ Skullcandy ☐ Panasonic
☐ JBL ☐ Sennheiser ☐ Other (please specify): _____

6) How long have you owned your current headset?

- ☐ Less than 3 months ☐ 3 - <6 months ☐ 6 - <12 months
☐ 1-2 years ☐ Over 2 years

7) Have you ever used a wireless headset?

- ☐ Yes ☐ No

8) What type of headset fit do you prefer?

- ☐ Headphones (On/Over-ear) ☐ Earbud (sits inside ear with no seal)
☐ Earphone (sits in ear creating a seal with the ear canal)

9) Branch: if user answers "headphones" for Q8 go to question 9a. If user answers "earbud" or "earphone", go to question 9b

a) What type of headset connection do you prefer?

- ☐ Wired ☐ Wireless

b) What type of headset connection do you prefer?

- ☐ Wired ☐ Wireless ☐ True Wireless

Definition: "Health Data" has been defined as heart rate, temperature, and calories burned.

"Waterproof" has been defined as being capable of operating at a depth of up to 1 meter for at least 30 minutes.

10) On a scale from 1 (least important) to 7 (most important), rate the following headphone attributes:

Attribute	Least Important				Most Important		
Brand Name	1	2	3	4	5	6	7
Health Data via app	1	2	3	4	5	6	7
Waterproof	1	2	3	4	5	6	7
Alexa/Siri/Google Assistant Compatible	1	2	3	4	5	6	7
Wired or Wireless	1	2	3	4	5	6	7
Price	1	2	3	4	5	6	7
Noise Cancellation	1	2	3	4	5	6	7
Sound Quality	1	2	3	4	5	6	7
Microphone Quality	1	2	3	4	5	6	7

11) On a scale from 1 (Strongly Disagree) to 5 (Strongly Agree), how do you identify with the following statements? *I like to use a headset...*

Strongly Disagree

Strongly Agree

While I am outdoors.	1	2	3	4	5
While I exercise.	1	2	3	4	5
While I watch movie on personal device.	1	2	3	4	5
While I work.	1	2	3	4	5
While I commute.	1	2	3	4	5
While I talk on the phone.	1	2	3	4	5
While I sleep.	1	2	3	4	5
While I eat.	1	2	3	4	5
While I shower.	1	2	3	4	5
While I study.	1	2	3	4	5

12) On a scale from 1(Strongly Disagree) to 7 (Strongly Agree), how do you identify with the following statements?

	Strongly Disagree			Strongly Agree		
I love entertainment	1	2	3	4	5	
I love finding new music	1	2	3	4	5	
I love fitness	1	2	3	4	5	
I love only one genre of music	1	2	3	4	5	
I love gaming	1	2	3	4	5	
I love hiking	1	2	3	4	5	
I love to be by the water	1	2	3	4	5	
I love outdoor sports	1	2	3	4	5	
I love to travel	1	2	3	4	5	
I love to cook	1	2	3	4	5	

Before continuing on to the next section, here is a reminder of the types of headsets:

Earbuds: Sits in the ear

Earphones: Sits in the ear, creates a seal with the ear canal

Wireless: a cord connects the earbuds/earphones together, but not to the device

True Wireless: no cords at all

13) Please indicate on a 1 (not likely at all) to 7 (definitely) scale how likely you would be to purchase this headset design?

Profile	Connection	Ear fit	Health Data	Price	Rating						
1	True Wireless	Earbud	Yes	\$199.99	1	2	3	4	5	6	7
2	True Wireless	Earphone	No	\$19.99	1	2	3	4	5	6	7
3	Wireless	Earphone	No	\$199.99	1	2	3	4	5	6	7
4	Wireless	Earphone	Yes	\$99.99	1	2	3	4	5	6	7

5	Wireless	Earbud	Yes	\$19.99	1	2	3	4	5	6	7
6	Wired	Earphone	Yes	\$199.99	1	2	3	4	5	6	7
7	Wired	Earphone	Yes	\$19.99	1	2	3	4	5	6	7
8	True Wireless	Earphone	Yes	\$99.99	1	2	3	4	5	6	7
9	Wired	Earbud	No	\$99.99	1	2	3	4	5	6	7

14) Where do you plan to be located geographically in the next 5 years?

- ☐ U.S. - West Coast ☐ U.S. - East Coast ☐ U.S. South
☐ U.S. - Midwest ☐ U.S. - Rocky Mountains
☐ Europe ☐ Asia ☐ South America
☐ Other (please specify): _____ ☐ Prefer not to answer

15) What gender do you identify as?

- ☐ Male ☐ Female ☐ Non-Binary/Other ☐ Prefer not to answer

16) What is your age?

- ☐ <16 ☐ 16-20 ☐ 21-25 ☐ 26-30 ☐ 31-35 ☐ 36-40 ☐ 41+

17) What is your education level? (Please select highest degree obtained or in progress for)

- ☐ High School Diploma/GED ☐ Undergraduate Degree
☐ Graduate Degree ☐ Did not earn any diploma or degree

18) What income bracket do you fall into?

- ☐ <\$25k ☐ \$25k - \$49k ☐ \$50k - \$74k ☐ \$75k - \$99k ☐ \$100k - \$149k ☐ >\$150
☐ Prefer not to answer