Marketing assignment: conjoint analysis for headphones

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I. Context and goal of the analysis

1. Product description and small history

For this analysis, I have chosen to focus on the market for audio headset.
Headphones originated from the earpiece. The first truly successful set was developed in 1910 by Nathaniel Baldwin, who sold them to the United States Navy. Consequently, the product has an old history, and we can assume that the market is fully mature, with a high level of competition and expertise. To be successful and to distinguish itself from the competition, a new audio headset must have innovative features or provide an ever better sound quality.

2. Competition analysis, features and prices

a) Overall competition

To analysis the concurrence, we have to look at two different levels and approaches. The market we could analyse is the market for audio equipment, which contains headphones with arches, wired or wireless (our product), inner-ear headphones, and earphones.

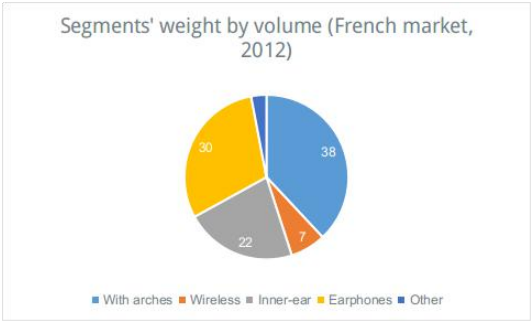
Wired headphones:
Bose QC35

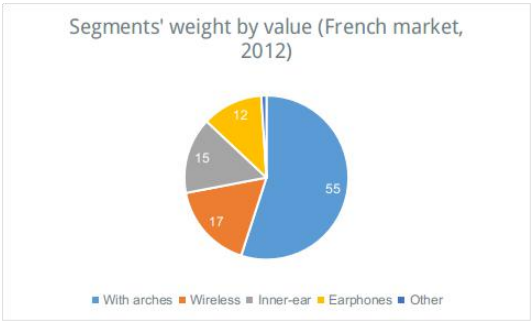
Wired headphones:
Philips FX5MBK/00

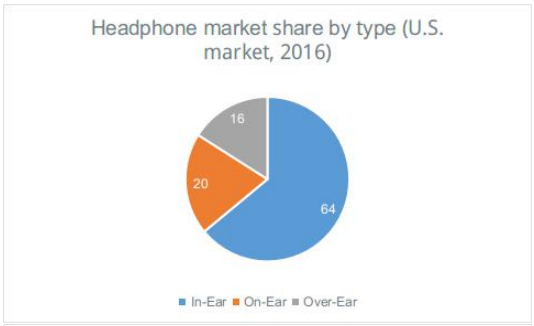
Inner-ear headphones:
Dcybel Liberty Sport

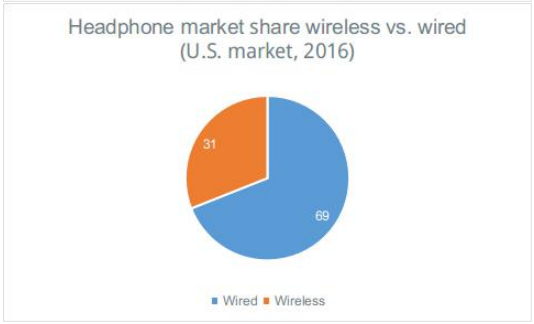
Earphones:
SonyMDR-E9

Headphones with arches (wireless or not) have a large part of this market, with a total of 45% of the volume of the French market (2012) and 72% of its overall value. In 2013, headphones represented 322 million euros in France (GFK). Moreover, we can observe that headsets (wireless or wired) generate the best profit with regards to the volume sold.









In the U.S., the headphones ("Over-ear") market share seems to be lower, with only 16% of the market. Within headphones category, wired headphones represent 70% of the market.

b) Direct competition

Now that we have seen all the competitors for audio equipment, let us focus on a narrower market, the headphones market. In this market, we have, as explained above, two kinds of headphones: wireless headphones (with bluetooth technology) and wired headphones.

Both can be characterized by the following features:

- Nominal impedance (in ohms)
- Sound pressure level (in dB)
- Frequency response (in Hz)
- Bluetooth technology (yes or no)
- Noise cancelling technology (yes or no)
- Price (in €)

Wired headphones have also these characteristics:

- Jack size (in millimeters)
- Cable length (in meters)

And for wireless/noise cancelling headphones:

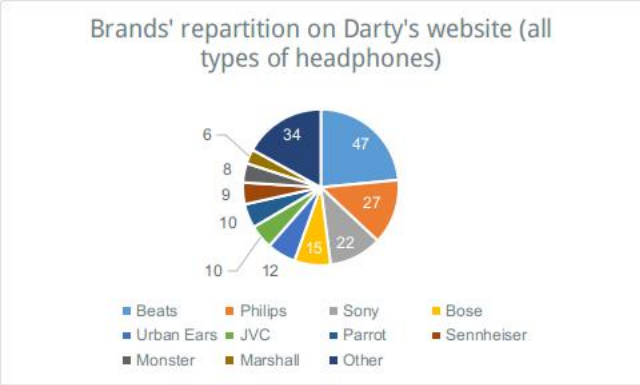
- Battery life (in hours)
- Cable length (if included)

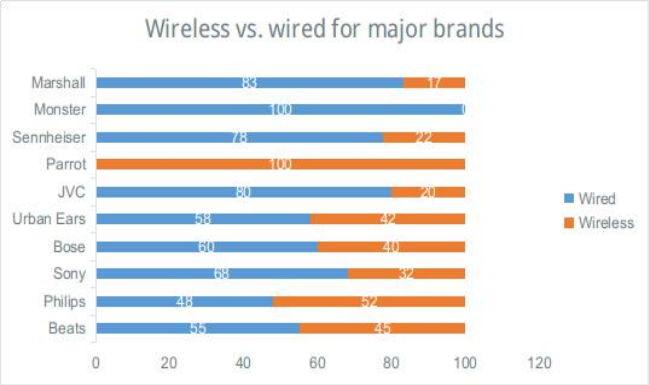
Some other optional attributes:

- ➢ Weight (in g)
- ➢ Foldable (yes or no)
- ➢ Designed for Apple products (yes or no)
- ➢ Color (red, blue, yellow, pink, green, white, black, grey…)

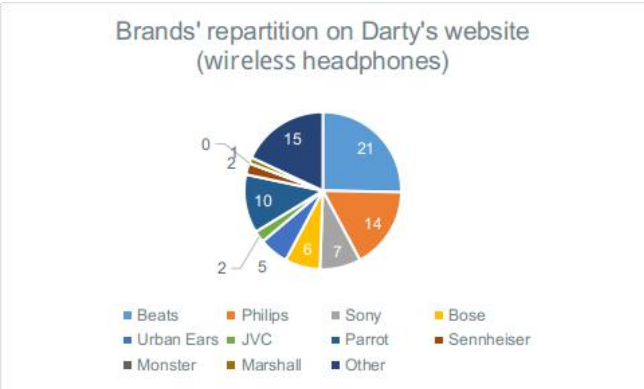
We can note that Bluetooth technology, noise cancelling technology, and "connectedness" are more widespread in premium product segments.

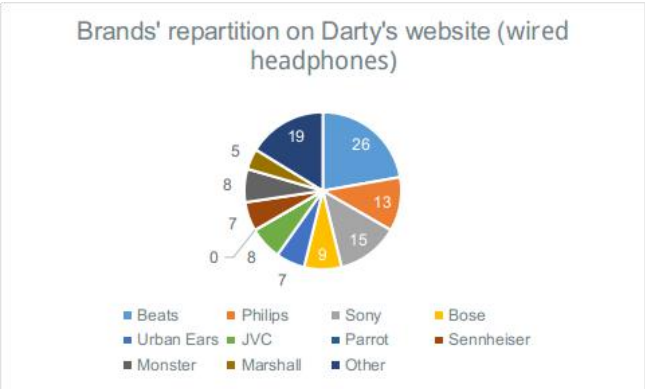
As for the competitors, as small study on the French website Darty[1] gave the following results:





We can firstly notice that Beats headphones have the biggest number of offers both for wired and wireless headphones. On the overall market, the brad represent almost the half of the offers[2]! Then come all minor brands[3]; Philips has the third position, but is preceded by Sony on the classic wired headphones market. Finally, the French brand Parrot occupies the fifth place. The competitors' rankings do not vary that much between the wired headphones market and the wireless headphones market.





[1] carried out on the section "headphones with arches" of the website http://www.darty.com/, with a sample of 200 offers.
[2] It must however be noted that Beats offers products with many color variations; and two identical models, but of a different color represent two different offers...
[3] Dcybel, Dynabass, Focal, Temium, Sol Republic, WESC, Plantronics, Skullcandy, Lexibook, Trainer, Halterrego, Samsung...

To conclude, our biggest competitors are:

c) Examples of bundles offered by the competition

On the Darty website, we also chose five bundles offered by the brands shortlisted above.

					
Name	Bose QC25	Beats New Studio	Parrot Zik 2.0	Philips SHB 9350 BK	Sony MDRZX310B. AE
Color	White	Blue	Yellow	Black	Black
Price	329.00€	199.00€	157.49€	99.00€	24.99€
Nominal impedance	N/A	N/A	N/A	32 ohms	N/A
Sound pressure level	N/A	N/A	58 dB	106 dB	98 dB
Frequency response	N/A	N/A	20 Hz-22 kHz	8 Hz-23.500 kHz	10 Hz-24 kHz
Jack	N/A	3.5 mm	3.5 mm	3.5 mm	3.5 mm
Cable length	1.42 m	1.3 m	1.3 m	1.2 m	1.2 m
Speaker diameter	N/A	N/A	40 mm	40 mm	30 mm
Weight	195 g	N/A	270 g	155 g	120 g
Bluetooth	No	No	Yes	Yes	No
Noise	Yes	Yes	Yes	No	No

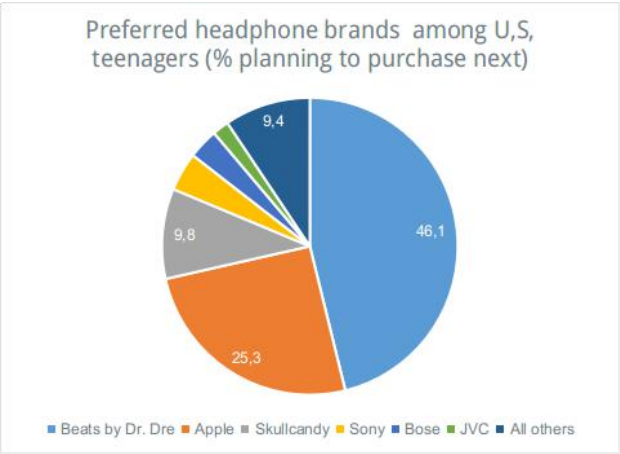
cancelling					
Battery	35h; AAA	20 h; rechargeable via USB	Li-ion; 830 mAh	Li-Polymer rechargeable	N/A
Accessories	Carry case; aircraft adapter; cable with microphone and remote	Cleaning cloth; rigid protective pouch; 3.17 mm to 6.35 mm adapter	USB cable; carry case; startup guide	USB cable; startup guide	N/A

We notice that the least expensive products do not offer the noise cancelling technology. For premium products, accessories (like additional cable for wireless headphones, USB cable, pouch…), are included in the bundle. What is more odd is that the most expensive offer (the Bose headphones) do not have the Bluetooth technology for instance. Finally, when the products become more expensive, more attention is paid to the design and the color variations. The customer that pays a premium for his headphones can even customize them (for the Bose product in particular).

3. New opportunities

Although the headphones market is a mature one, the firms still try to seduce new segments, and to introduce innovations in their products. I think that two facts about these market changes could be underlined: the growing importance of the youth segment and of attractive design; and the growing popularity of premium headphones.

a) Seduce the youth segment



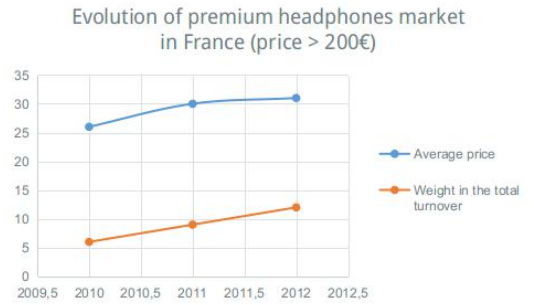
According a recent study[4], teens' desires in terms of headphones are quite different from what is reflected by the current market.

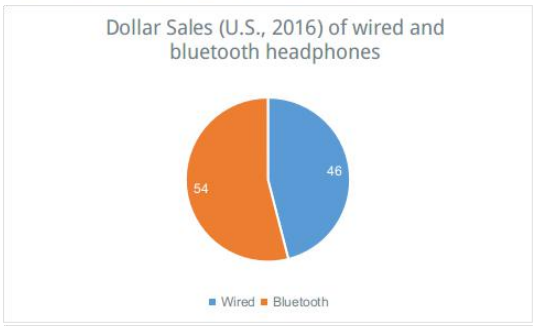
Obviously, Beats occupies once more the first place in the teens' preferences, but a brand like Skullcandy, for instance, is undoubtedly more popular in this segment than all the others. This brands offered, however, very fancy headphones, with a great design and at prices they can afford.

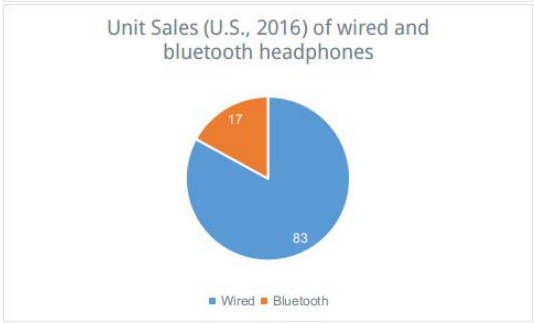
Maybe headphones are becoming more and more like a garment for urban people, and consequently, they them to be stylish. So I think the design is definitely a crucial feature, on which we will have to focus during the conjoint analysis, in order to better understand the customer's' desires.

[4] Felix Richter, Data Journalist, felix.richter@statista.com, spring 2014

b) Develop a premium product







A French study from 2013[5] showed that the market of premium headphones (whose prices are above 200€) is now growing: people want a better sound experience. The weight of this segment in the total turnover has more than doubled.

Moreover, more recent American study[6] showed very encouraging results about the premium segment; Bluetooth headphone represent only 17% of the total sales, but contribute more than 50% to the total market revenue! So, I think there is much money to earn by producing very Hi-Tech products in this market, even if some segments are more likely to be neglected.

[5] GfK Consumer Choices France

[6] Felix Richter, Data Journalist, felix.richter@statista.com, spring 2016

c) Segmentation choice

No that the two growing segments have been presented (teens and premium), it is time to choose. So I will choose to focus on the second one, the premium segment. Indeed,I think this segment will be more interesting to conduct in the context of conjoint analysis, because it implies many parameters (both design, quality, and technology). The youth segment, to the contrary, is most of the time polarised on design, which is interesting, but not that much.

II. Design of the analysis

1. Attributes and levels

a) Attributes

I have selected five attributes for this analysis:

- Frequency response: it is the measure of a headphone's ability to reproduce all frequencies equally; the larger is the frequency range, the richer the sound[7]. Since we will try to target a premium segment, our potential customers will be very attentive to the quality and the sound experience. They are expected to look at the bitrate of their tracks, and the technical features of their equipment. That is why this feature seems to be relevant.
- Bluetooth technology: it is a critical factor in the listening comfort (no risk to have the music interrupted when the jack is unplugged inadvertently, no entangled cables…). Being more free to move improves the sound experience; but it will be also interesting to measure the trade-off people make between comfort of wireless devices, and their inherent time-limitation (battery life…).
- Noise cancelling: it also improve the sound experience. People can focus on their music, without being disturbed. But this feature, as we have seen, has a price. How much people will be willing to pay for it?
- Design: as we have seen, this feature seems to be more and more important. Because headphones accompany us all day long, they become a new kind of garment or accessory, and consequently, they have to adapt to fashion and to become customizable.
- Price: important, even for premium products. One must find the higher price acceptable by the customer, but not too high!

Battery life could have been an interesting criterium too, but unfortunately it is highly correlated with the "Bluetooth" criteria, which means that, for instance, a profile "Bluetooth==No + Battery life == [0h - 15h]" is meaningless... So choosing this feature for conjoint analysis could have led to problems during the generation of the orthogonal design[8].

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[7] However, the sound quality is also limited by the sample rate of the music (hearing a 128kbps track with headphones having a good frequency response does not improve the quality!).

[8] Moreover, it turns out that the informations given by the brands for battery life may vary a lot, and are rarely correct. Indeed, battery life depends on the volume of the music; consequently, headphones will work longer if they are used for noise cancelling only... And of course, this measure, more advantageous, is often kept by the constructors!

b) Levels

Levels are:

- Frequency response: [20 Hz - 20 kHz] (most widespread, average quality); [10 Hz - 27 kHz] (rarer, good quality); [5 Hz - 35 kHz] (very rare, premium quality)
- Bluetooth technology: Yes; No
- Noise cancelling: Yes; No
- Price: 50€ (low cost); 100€ (mid-range); 200€ (high end); 300€ (premium)
- Design: Refined; Old School; Fancy

"Refined" design:
Bose QC35 Silver

"Fancy" design:
Beats Solo 2 Blush Pink

"Old School" design:
Marshall Monitor Black

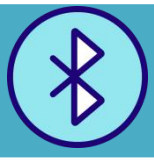
c) Synthetic table

Attribute		Level 1	Level 2	Level 3	Level 4
	Frequency response	[20 Hz - 20 kHz]	[10 Hz - 27 kHz]	[5 Hz - 35 kHz]	N/A
	Bluetooth technology	Yes	No	N/A	N/A
	Noise cancelling	Yes	No	N/A	N/A
	Price	50€	100€	200€	300€

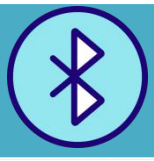
	Design	Refined	Old school	Fancy	N/A

d) Orthogonal design output

I used the Excel macro available on Blackboard to generate 18 orthogonal bundles. The raw output was:

Profile					
(1)	1	1	2	2	3
(2)	2	2	2	1	1
(3)	1	2	1	2	1
(4)	3	1	2	3	1
(5)	2	2	1	3	3
(6)	3	1	1	1	3
(7)	2	1	2	2	2
(8)	1	1	1	1	2
(9)	2	1	1	4	1
(10)	1	2	2	4	3
(11)	1	1	2	3	1
(12)	1	2	1	3	2
(13)	3	2	2	4	2
(14)	1	2	2	1	1
(15)	1	1	1	4	1
(16)	3	2	1	2	1

Which is translated into:

Profile					
(1)	[20 Hz - 20 kHz]	Yes	No	100€	Fancy
(2)	[10 Hz - 27 kHz]	No	No	50€	Refined
(3)	[20 Hz - 20 kHz]	No	Yes	100€	Refined
(4)	[5 Hz - 35 kHz]	Yes	No	200€	Refined
(5)	[10 Hz - 27 kHz]	No	Yes	200€	Fancy

(6)	[5 Hz - 35 kHz]	Yes	Yes	50€	Fancy
(7)	[10 Hz - 27 kHz]	Yes	No	100€	Old school
(8)	[20 Hz - 20 kHz]	Yes	Yes	50€	Old school
(9)	[10 Hz - 27 kHz]	Yes	Yes	300€	Refined
(10)	[20 Hz - 20 kHz]	No	No	300€	Fancy
(11)	[20 Hz - 20 kHz]	Yes	No	200€	Refined
(12)	[20 Hz - 20 kHz]	No	Yes	200€	Old school
(13)	[5 Hz - 35 kHz]	No	No	300€	Old school
(14)	[20 Hz - 20 kHz]	No	No	50€	Refined
(15)	[20 Hz - 20 kHz]	Yes	Yes	300€	Refined
(16)	[5 Hz - 35 kHz]	No	Yes	100€	Refined

2. Data collection

a) Survey conditions

The survey will be conducted mostly *via* Internet, using Google Forms. To enhance the participation, I will post some messages on Facebook private groups (like the student page of HEC and Télécom ParisTech, my engineering school...) and my personnal wall. I will talk to my close friends and relatives, and give them paper versions, so that they can answer immediately, without opening their laptops.
The risk with online forms is that some people would answer randomly, but it saves valuable time, and one can hope that in average, the aberrant results will be smoothed. Doing a paper version could maybe encourage people to do the test seriously, especially if we know each other very well.
As for the number of respondents, a good performance would be maybe 150 people. More would be better however, especially because of the numerous features I selected (five features...).

b) Survey relevance

With this survey, I would like to target urban and quite wealthy young adults, from 20 to 40. “Young adults”, because they are both receptive to new technologies (they listen to music on their laptop or smartphone almost every day), and concerned about the sound quality and the technical features of the product, something that teens do not, most of the time. So this age group seems to be the most likely to buy new premium headphones.
Then, they have to be “urban”, because firstly, people who live in big cities use more often their headphones (in crawded public transportation for instance!), and secondly, because they are maybe more expected to pay more attention to design and trend, which is one of our selected features. Finally, we look for “wealthy” people, because headphones prices vary in a very large range, and so wealthy people (who have in average a higher willingness to pay) could give us better results (more spread).
This segment seems to be relevant regarding theprofile of a potential buyer of premium headphones, and furthermore, it appears to be a convenient segment, because it summarizes the situation of people I meet most of the time...

To complete the survey, I will add at the end some additionnal questions, to segment the respondants. These questions will be:

- What is your age?

Answers: 12-25 years; 25-40 years; 40-60 years; 60+ years; Don't want to tell)

➢ What is your occupation?

Answers: Student; Technical; Manager; Service worker; Homemaker; Laborer; Eduation; Sales; Retired; Unemployed...

➢ What is your gender?

Answers: Female; Male; Don't want to tell

These questions could help during a potential merchandising or advertising phase, and would also refine the segmentation.

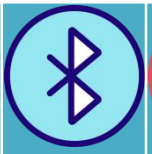
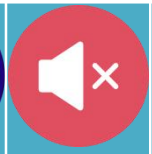
3. Data analysis (basic approach)

a) Coding the variables

We coded the features with dummy variables, as follows:

													
[20Hz; 20kHz]	[10Hz; 27kHz]	[5Hz; 35kHz]	Yes	No	Yes	No	50€	100€	200€	300€	Refined	Old school	Fancy
0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Which gave the following table for our bundles:

														
	[20Hz; 20kHz]	[10Hz; 27kHez]	[5Hz; 35kHz]	Yes	No	Yes	No	50€	100€	200€	300€	Refined	Old school	Fancy
Bundle 1	1	0	0	1	0	0	1	0	1	0	0	0	0	1
Bundle 2	0	1	0	0	1	0	1	1	0	0	0	1	0	0
Bundle 3	1	0	0	0	1	1	0	0	1	0	0	1	0	0
Bundle 4	0	0	1	1	0	0	1	0	0	1	0	1	0	0
Bundle 5	0	1	0	0	1	1	0	0	0	1	0	0	0	1
Bundle 6	0	0	1	1	0	1	0	1	0	0	0	0	0	1
Bundle 7	0	1	0	1	0	0	1	0	1	0	0	0	1	0
Bundle 8	1	0	0	1	0	1	0	1	0	0	0	0	1	0
Bundle 9	0	1	0	1	0	1	0	0	0	0	1	1	0	0
Bundle 10	1	0	0	0	1	0	1	0	0	0	1	0	0	1
Bundle 11	1	0	0	1	0	0	1	0	0	1	0	1	0	0
Bundle 12	1	0	0	0	1	1	0	0	0	1	0	0	1	0
Bundle 13	0	0	1	0	1	0	1	0	0	0	1	0	1	0
Bundle 14	1	0	0	0	1	0	1	1	0	0	0	1	0	0
Bundle 15	1	0	0	1	0	1	0	0	0	0	1	1	0	0
Bundle 16	0	0	1	0	1	1	0	0	1	0	0	1	0	0

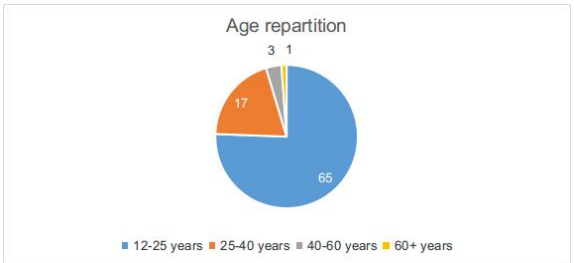
For each feature, we chose to “delete” the last column (which could be found from the others). These columns put together would become the features of the “baseline product”. It have thus the following properties:

[5Hz; 35kHz]	No Bluetooth	No noise cancelling	300€	Fancy design

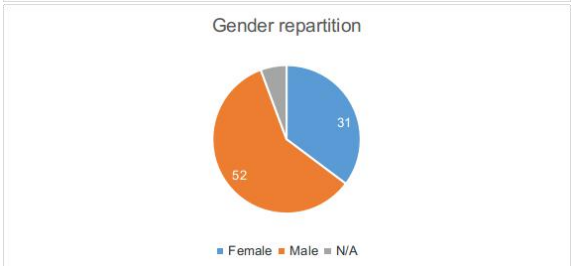
b) Data collection

I collected 90 answers in total, from friends, social networks (Facebook, Linkedin), unknown HEC students (*via* HEC mail), and family.

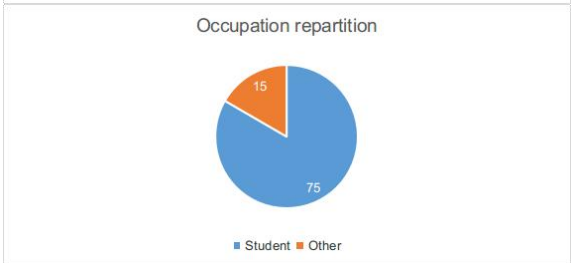
Most of the respondents were young people, between 12 and 25 years (65%). I had another rather big group of young adults, between 25 and 40 years (17%). Senior people werequite seldom.



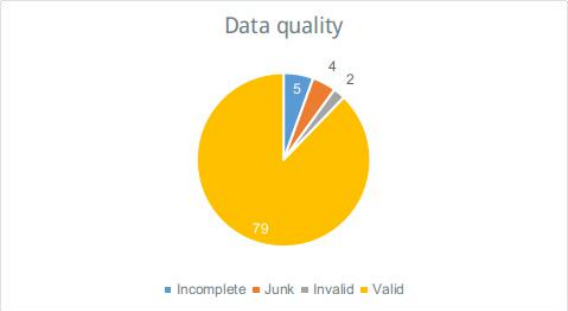
As for gender, most of the respondents were men[9] (52%, vs 31% women). A little fraction did not want to tell.



An overwhelming majority of the respondents were still students. They represented three quarters of the answers. The others were homemakers, engineers, managers or worker in public service for instance. But the stats were to small[10], so I chose to group all these categories.



Finally, the quality of the answer was quite good in average, except some abnormal results, which I called "Junk"[11]. There were 4 "junk" answers, but also 2 "invalid" results (every field blank), and 5 "incomplete" (1 or 2 fields blank). These last results were still exploited[12]. "Junk" and "invalid" answers have not been used for further individual regressions.



[9] maybe because I come from an engineering school, were women represent only 20% of the students...

[10] often less than 5 people for one category, which could be a problem for the relevance of the demographic stats during particular regressions (P-value...).

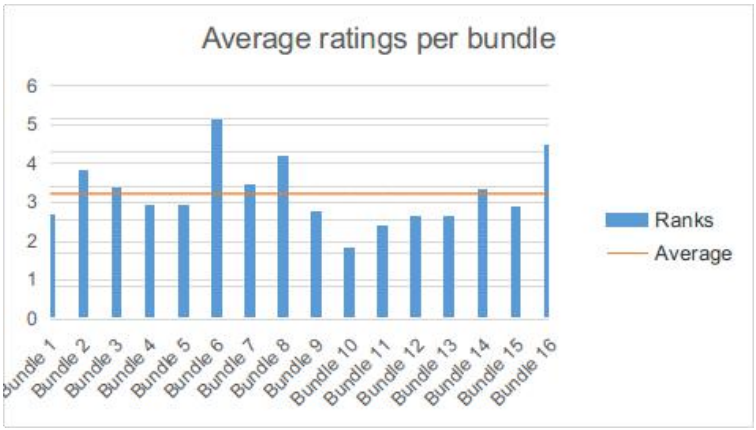
[11] people who obviously did not take the test seriously, by answering always "1" or always "3".

[12] I put the average rating of the product when its field was blank.

c) First basic regression

First I tried to run a basic regression, without considering any demographic group in particular.
Thus, I computed for each bundle (16 bundles) the average of all the rating available. I obtained the following results:

	Ratings	
	Average	Per bundle
Bundle 1	3,21130334	2,67816092
Bundle 2		3,827586207
Bundle 3		3,379310345
Bundle 4		2,91954023
Bundle 5		2,91954023
Bundle 6		5,113636364
Bundle 7		3,465909091
Bundle 8		4,183908046
Bundle 9		2,75
Bundle 10		1,818181818
Bundle 11		2,406976744
Bundle 12		2,625
Bundle 13		2,636363636
Bundle 14		3,333333333
Bundle 15		2,863636364
Bundle 16		4,459770115



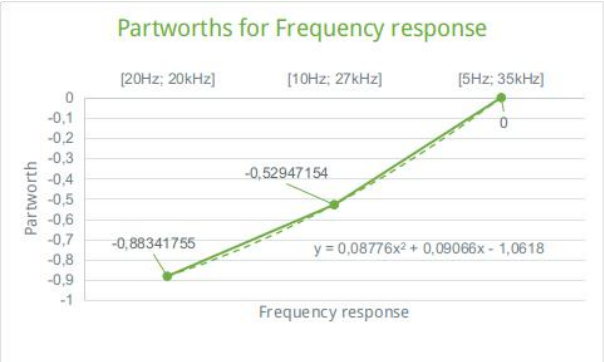
We can notice that the sixth bundle is the most popular over the population. It is cheap (50€), has a fancy design, Bluetooth technology, noise cancelling, and an excellent sound quality. Actually it sounds quite resonable to choose it...
The less popular bundle is the tenth one. Once again it is not very surprising: the tenth bundle is very expensive (300€), without any advanced technology (no Bluetooth, no noise cancelling), and with a bad sound quality. So for now then, the results seem to be quite OK.

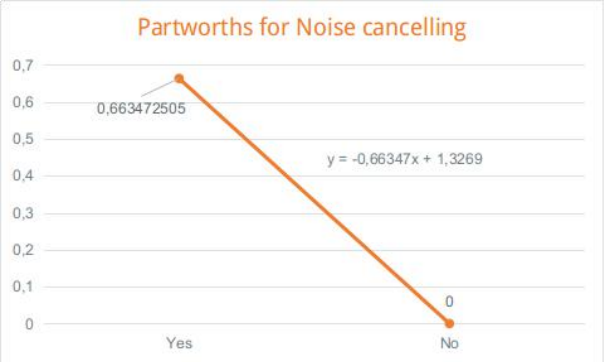
Then we ran the linear regression using the average ratings above, to obtain the following partworths:

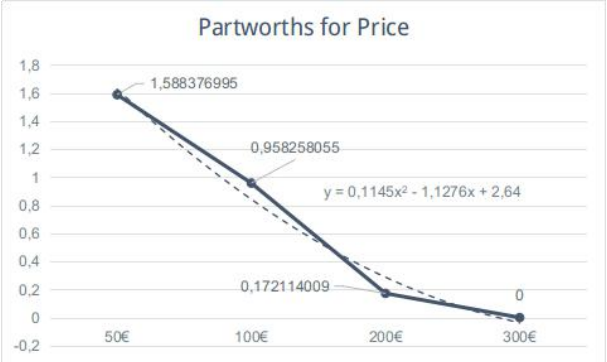
Partworths			
Intercept	2,54381728		Ideal profile
Frequency response	[20Hz; 20kHz]	-0,883417551	[5Hz; 35kHz]
	[10Hz; 27kHz]	-0,529471545	
	[5Hz; 35kHz]	0	
Bluetooth	Yes	0,248150501	Yes
	No	0	
Noise cancelling	Yes	0,663472505	Yes
	No	0	
Price	50€	1,588376995	300€
	100€	0,958258055	
	200€	0,172114009	
	300€	0	
Design	Refined	0,082613012	Fancy
	Old school	0,083785005	

	Fancy	0	

Almost all P-values were below 5%, except for Bluetooth, 200€, refined and old school designs. They were exceptionnaly high for the design-related features (50-60%). So maybe the design was not a relevant feature to keep in this analysis. All in all, here are the plots of these partworths:







We can conclude that:

- People prefer high quality sound: the function can be approximated with an hyperbola. There is more elasticity from [10Hz; 27Hz] to [5Hz; 35Hz] than from [20Hz; 20kHz] to [10Hz; 27kHz].But the difference is not striking;
- People prefer noise cancelling “more” than they prefer Bluetooth, Both functions can be approximated with a linear function, but the slope for noise cancelling is steeper (about three times steeper than Bluetooth’s slope);
- People prefer cheap products, with a linear price elasticity from 50€ to 200€. For 200€ and above, people are less price sensitive (but are also very reluctant towards the product!);
- People do not like Fancy products! Their tastes are more classical. Refined and old school products seem to earn roughly the same scores, well above fancy products.

d) Individual regression

I tried to run a regression for each respndent, with a quite tricky formula (including the LINEST function, rather than the function from the Data Analysis Toolpak). The Excel file only provides basic results, that is to say, coefficients and intercept for each respndent (without P-values and residuals). I did not conduct further analysis on this dataset. The results are compiled in the sheet "Individual partworths" in the Exel file.

4. Data analysis (demographic approach)

a) Demographic groups

To conduct this more extended analysis, I chose to focus on 7 demographic groups, based on 3 different demographic criteria:

Occupation	Student
	Other
Age	12-25 years
	25-40 years
	40+ years
Gender	Female
	Male

I chose to group all professions in the category "Other occupation" because of the small headcounts. Same thing for the age ranges (I grouped 40-60 years and 60+ years in the catgory "40+").

b) Average ratings computation

So again, for each group, I computed the average rating separately for the 16 bundles.

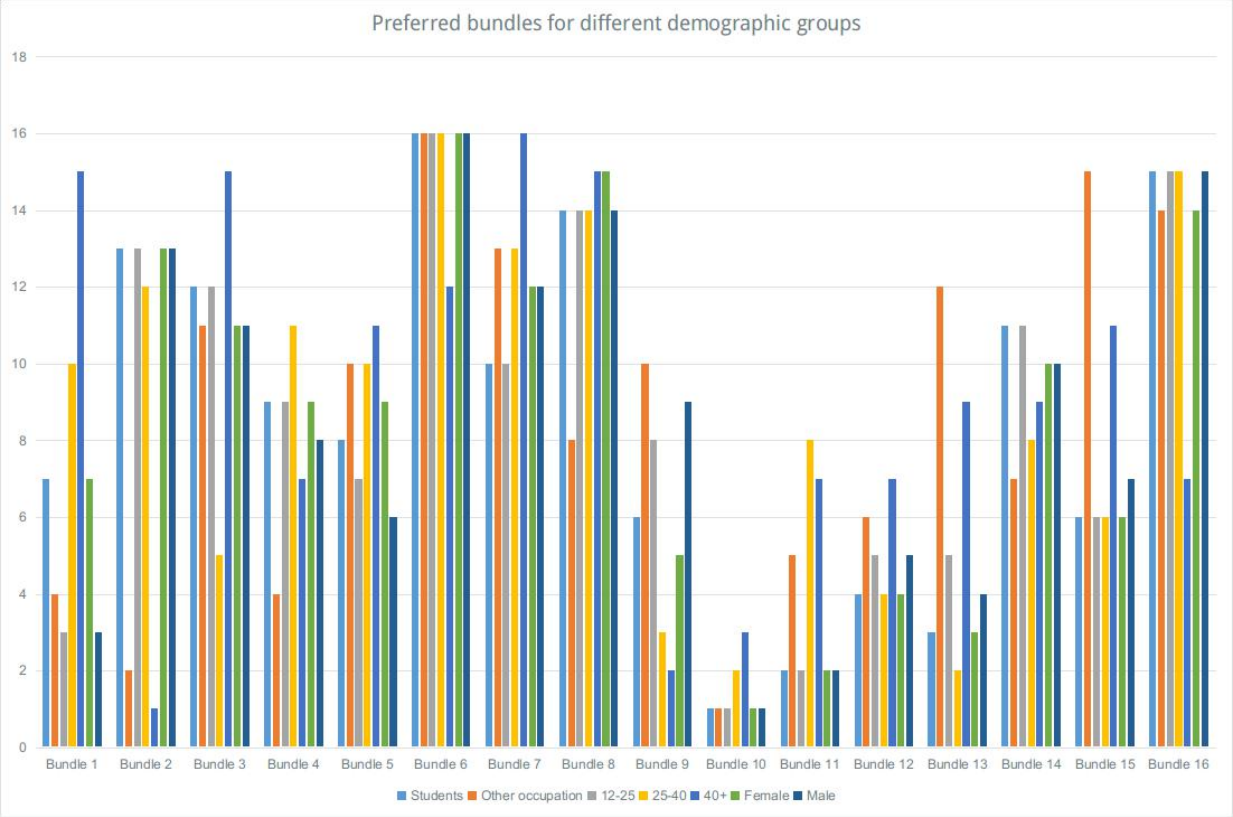
	Students	Other occupation	12-25	25-40	40+	Female	Male
Bundle 1	2,938526584	2,938526584	2,609375	2,529411765	4,25	2,9	2,403846154
Bundle 2	3,409282617	3,409282617	4,203125	3,117647059	2	3,533333333	4,192307692
Bundle 3	3,382511312	3,382511312	3,625	2,352941176	4,25	3,3	3,384615385
Bundle 4	2,887903469	2,887903469	3	2,588235294	3	2,966666667	2,884615385
Bundle 5	2,972773379	2,972773379	2,90625	2,529411765	3,75	2,966666667	2,711538462
Bundle 6	4,906399066	4,906399066	5,2	4,941176471	4	4,967741935	5,423076923
Bundle 7	3,663146986	3,663146986	3,446153846	3,411764706	4,5	3,419354839	3,538461538
Bundle 8	4,164112903	4,164112903	4,384615385	3,5625	4,25	4,258064516	4,365384615
Bundle 9	2,560827616	2,560827616	2,938461538	2,176470588	2,25	2,516129032	2,923076923
Bundle 10	1,94784411	1,94784411	1,707692308	2,058823529	2,5	1,741935484	1,730769231
Bundle 11	2,503245968	2,503245968	2,359375	2,4375	3	2,419354839	2,3
Bundle 12	2,598448402	2,598448402	2,676923077	2,235294118	3	2,483870968	2,596153846
Bundle 13	2,649010363	2,649010363	2,676923077	2,058823529	3,5	2,451612903	2,557692308

Bundle 14	3,196397971	3,196397971	3,492307692	2,4375	3,5	3,258064516	3,294117647
Bundle 15	2,907836812	2,907836812	2,892307692	2,411764706	3,75	2,677419355	2,807692308
Bundle 16	4,094165815	4,094165815	4,630769231	3,941176471	3	4,225806452	4,673076923

I also computed the rankings in order to make things clearer:

	Students	Other occupation	12-25	25-40	40+	Female	Male
Bundle 1	10	13	14	7	2	10	14
Bundle 2	4	15	4	5	16	4	4
Bundle 3	5	6	5	12	2	6	6
Bundle 4	8	13	8	6	10	8	9
Bundle 5	9	7	10	7	6	8	11
Bundle 6	1	1	1	1	5	1	1
Bundle 7	7	4	7	4	1	5	5
Bundle 8	3	9	3	3	2	2	3
Bundle 9	11	7	9	14	15	12	8
Bundle 10	16	16	16	15	14	16	16
Bundle 11	15	12	15	9	10	15	15
Bundle 12	13	11	12	13	10	13	12
Bundle 13	14	5	12	15	8	14	13
Bundle 14	6	10	6	9	8	7	7
Bundle 15	11	2	11	11	6	11	10
Bundle 16	2	3	2	2	10	3	2

I also made a histogram with these rankings, to better visualize the differences between groups:



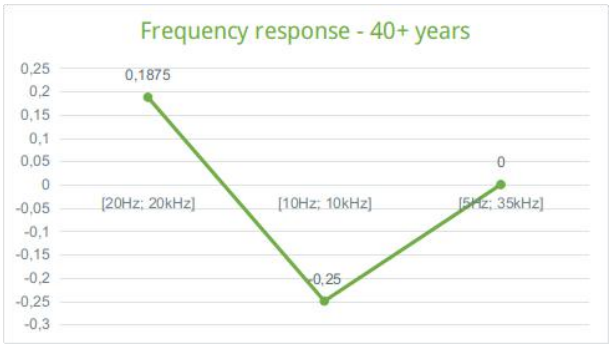
We can notice that all groups agree to rate the tenth bundle as the worst one (all the bars are very low for all groups). Similarly, they agree to rate the sixth bundle as the best one (except 40+ years, whose bar seem to be surprisingly lower that the others for this product...).
More "controversial" products are for instance the ninth one or the second one. The second one is very cheap in every sense of the word, students like it very much, but not 40+-years-old. Conversely, the ninth product is a premium product, and it pleases men and employed people more than 25-40+-years-old.

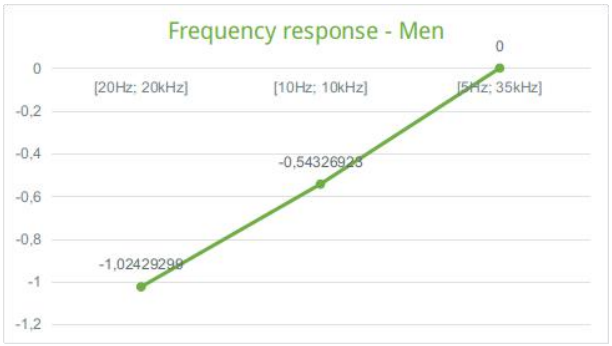
c) Regression and partworths

Then we use the Data Analysis Toolpak to compute the linear regression coefficients for each group based on the corresponding average ratings, and we plotted the partworths. The complete data are available in the Excel file, here we will just note the more significant differences between groups.

i. Frequency response

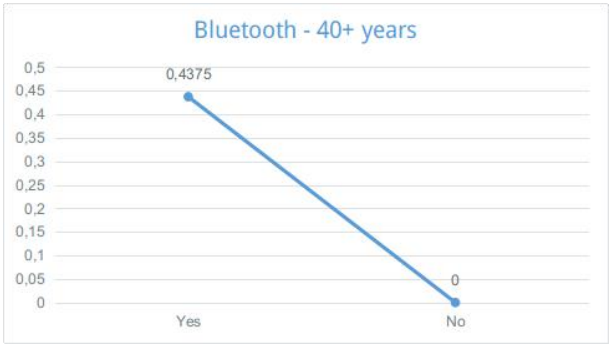
All groups seem to follow the same trend (preference on better sound quality), excet the 40+year-old. Indeed, the plot has a curious U-shape for this last group, whereas it is just linear for the other. We can conclude that the 40+ years group is a little composite, and have to be segmented between people who pay attention to quality, and people who do not.
As for the other "regular" curves, most of them are a little "folded": people are more sensitive to the gap between low and high quality, than to the gap between high and premium quality. Only men seem to have a very linear preference. Moreover, they are the group with the biggest range for this feature: they are apparently very attentive to the quality.

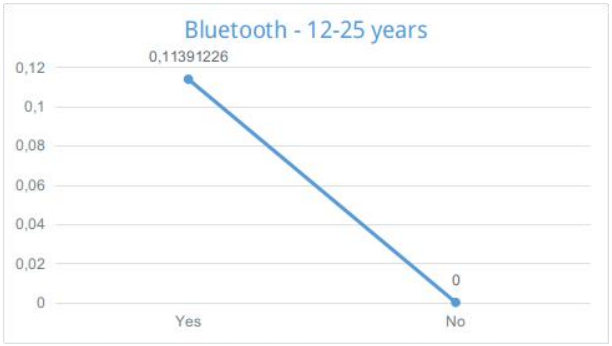




ii. Bluetooth

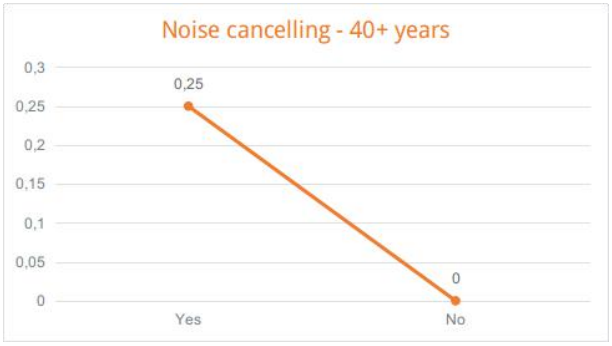
All groups prefer Bluetooth. The slope varies from 0,11 to 0,43 (interms of absolute value). Students, 12-25 years and men have no strong preference for Bluetooth (slope below 0,2). On the contrary, 25-40 years and 40+ years pay much more attention to this feature (slope above 0,4).





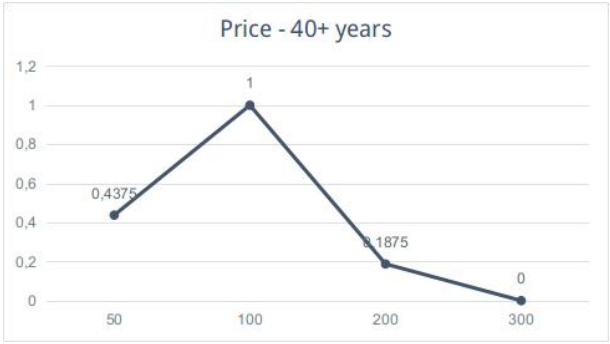
iii. Noise cancelling

On average, people pay more attention to noise cancelling than to Bluetooth: the slope goes from 0,25 to 0,79. Whet is more interesting is that the group which pay the more attention to Bluetooth pay the less attention to noise cancelling, and vice versa. For instance, the 40+years, who were very demanding on Bluetooth (0,44 slope), do not care about noise cancelling (0,25 slope). The 12-25 years group, which was not interested in Bluetooth (0,11 slope), pay much more attention to noise cancelling (0,72 slope).



iv. Price

For all groups (except for the groups "Other occupation"[13] and "40+ years"), we notice that the partworths vary linearly with the price, in the range [50€; 200€]. Above 200€, the price elasticity decreases, and people are less reactive to price changes. The partworths for this criteria are high for students, and more generally for young people (12-25 years). They become lower for higher age ranges.
What is more, women's partworths are more spread between the different prices that men's: their curve is almost linear, whereas the men's curve has an inflexion point at 300€.
As for the 40+ years group, we can notice a kind of Veblen effect at the point 100€: people from this group prefer to pay 100€ than 50€, maybe because they mistrust products that are too cheap, which they expect to be also of cheap quality.



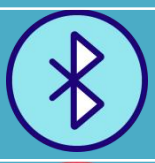
v. Design

The design seems to be the more cotroversial feature! People can be segemnted into three groups: groups for which the curve is decreasing (Refined>Old school>Fancy); groups for which the curve as a peak (Old school>Fancy, Refined); and a group for which the curve is increasing (Refined<Old school<Fancy).
The first group, with the decreasing curve, is made up of students, 12-25 years-old, and men. The second group, with the peak, consists of other occupations, women, 40+ years-old. Finally, the third group, maybe more minor, is only comprised of the 25-40 years-old.
Surprisingly, design is not such a big thing for students and for women (the preferred feature has only a partworth respectively of 0,13 and 0,009); conversely, it is very important for 25-40 years and 40+ years.
It is also interesting to notice that men and women have different tastes: women have a small aversion towards "Refined" designs, while men have a quite strong preference for it.

[13] The curve for this group is really hard to understand, because of the two inflexion points at 100€ and 300€. Maybe there was a lack of data, or random answers in this category...

vi. Summary

The main informations about demographic segmentation are compiled in the table below:

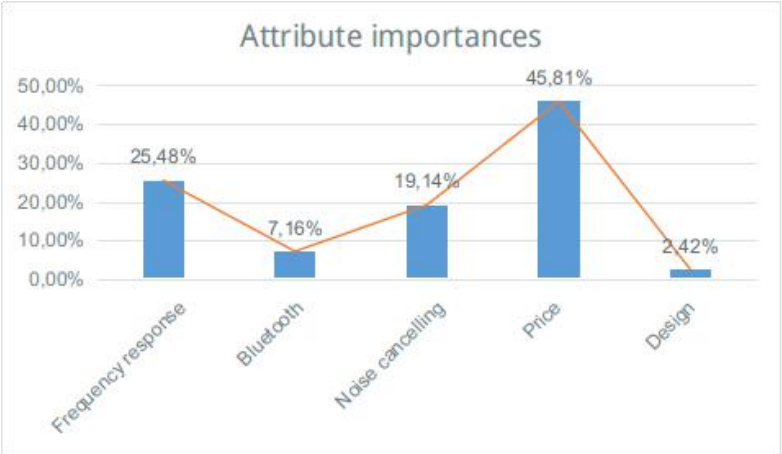
	40+ years	Low or very high quality
	All others	High quality
	All groups	Bluetooth rather than wired
	All groups	With noise cancelling rather than without
	40+ years	100€ better than 50€; above 100€, the cheaper the better
	Other occupations	Really strange: lack of data?
	All others	The cheaper the better
	Students, 12-25 years, men	Refined>Old school>Fancy
	Other occupations, women, 40+ years	Old school>Fancy, Refined
	25-40 years	Refined<Old school<Fancy

5. Importances

a) Basic approach

On the basis of the overall partworths, I computedthe corresponding ranges and importances:

	Range	Importance
	0,883417551	25,48%
	0,248150501	7,16%
	0,663472505	19,14%
	1,588376995	45,81%
	0,083785005	2,42%

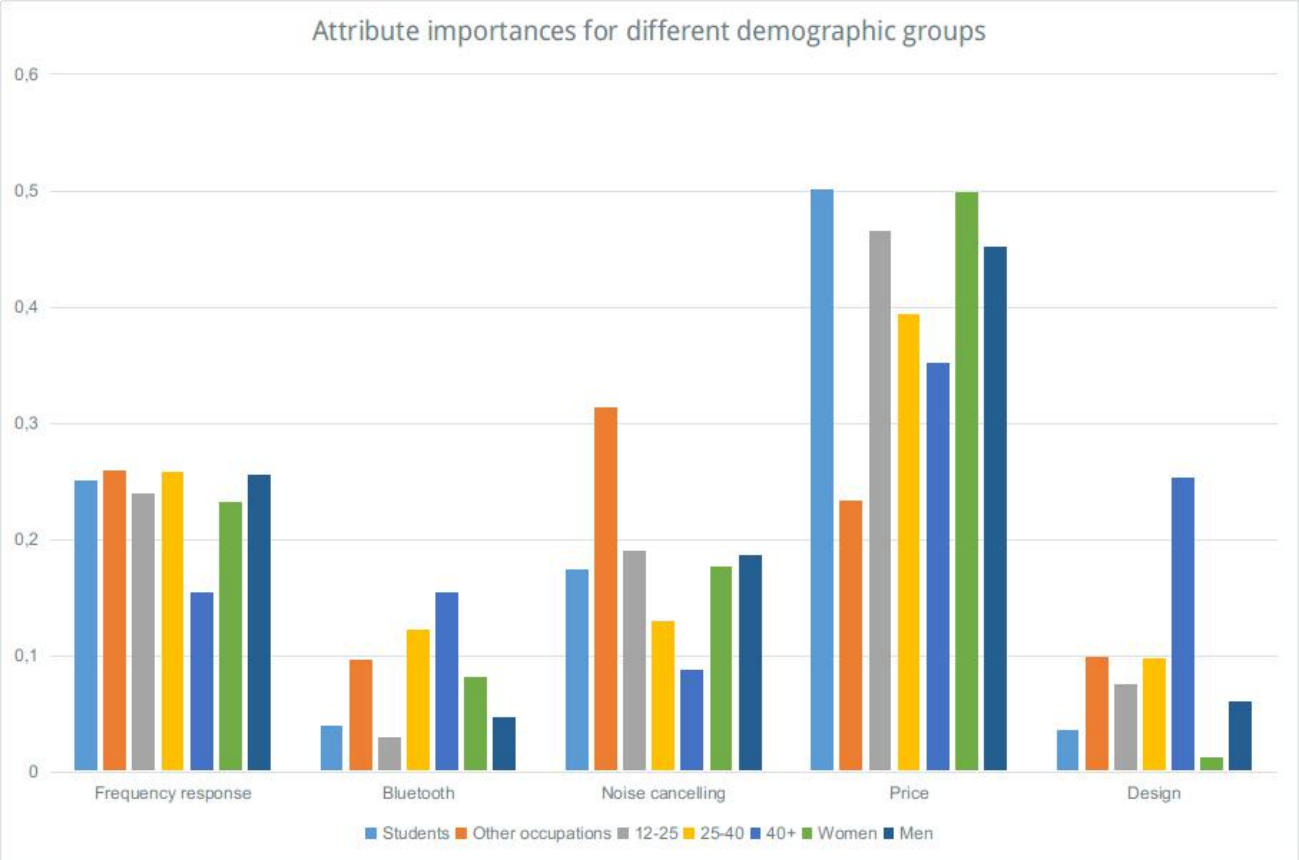


The price appears to be the crucial factor when evaluating a product. Then come frequency response, noise cancelling, Bluetooth, and finally design. Surprisingly, Bluetooth has quite a low importance; compared with

noise cancelling (about 2,7 times more important!). Design has also an exceptionally low importance (about 5% of the price's importance...).

b) Demographic approach

I also computed separate importances on the basis of demographic data:



We can see here that depending on the feature, the importances are more or less spread from one group to another. For instance, they are quite uniform for "Frequency response": between 0,2 and 0,3 for all groups, except the 40+ years-old. It is almost the same thing fo design, were all importances are under 0,1, except for 40+-years old.
We can notice more significant differences for price, which is a very important feature for students, 12-25 years-old, and both men and women. Conversely, "other occupations" and 40+ years-old do not really care about it[14].

6. Launching a new product

a) Basic apporach

Like in the class example, I tried to predict the choice of the "average consumer" by computing his utility, for three different products:

[14] compared to the others of course! The price's importance remains very high for all groups.

			
Product name	Sennheiser Momentum WL (Ivory)	Sennheider HD 2.10	Beats Solo HD by Dr. Dre (Green)
	[16Hz; 22kHz]	[18Hz; 18kHz]	[20Hz; 20kHz]
	Bluetooth	No Bluetooth	No Bluetooth
	Noise cancelling	No noise cancelling	No noise cancelling
	279,00€	49,90€	93,49€
	Old school	Refined	Fancy

The first product was very “premium”, the second very “cheap”; the third product was a fancy one, quite expensive for the functionnalities it provides. Iobtained the following results:

Attributes															
Levels	[20Hz; 20kHz]	[10Hz;	[5Hz;	Yes	No	Yes	No	50€	100€	200€	300€	Refined	Old	Fancy	Utility	Predicted choice
Sennheiser HD 2.10	1	0	0	0	1	0	1	1	0	0	0	1	0	0	3,331389736	
Sennheiser Momentum WL (Ivory)	1	0	0	1	0	1	0	0	0	0	1	0	1	0	2,655807739	SENNHEISER HD 2.10
Beats Solo HD by Dr. Dre (Green)	1	0	0	0	1	0	1	0	1	0	0	0	0	1	2,618657784	

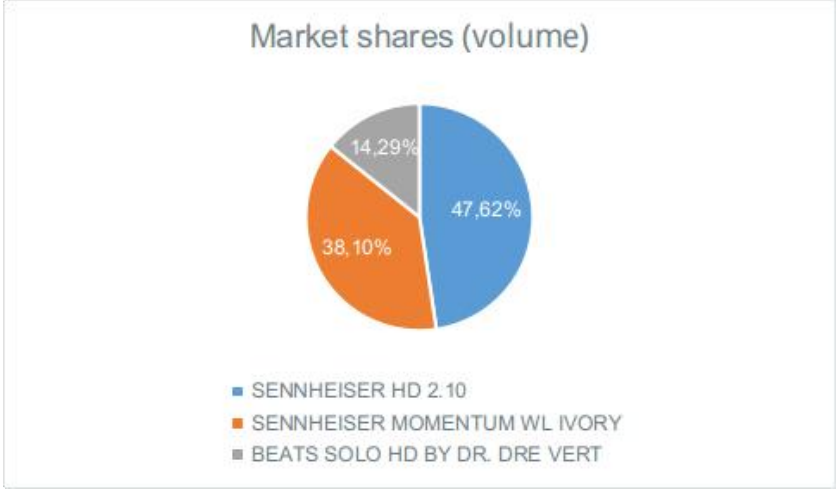
So people would prefer a premium product in this case.

b) Individual-by-individual approach

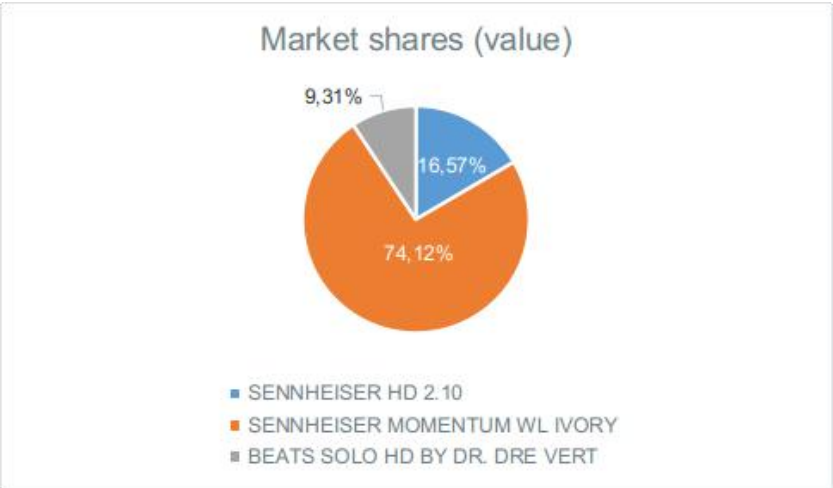
As it has been said before, I computed the partworths for each respondent individually. Thus, it became possible to determine the market shares of our three products, on the basis of these partworths. Given an individual partworth, I simply computed the three utilities (one for each product), and kept the product with the highest

utility. To perform this task, I used the incomplete answers (completed with average data), but I did not count "junk" answers (with only "1" for instance). The results were:

Product	Number of potential purchases	Market shares
Sennheiser HD 2.10	40	47,62%
Sennheiser Momentum WL (Ivory)	32	38,10%
Beats Solo HD by Dr.Dre (Green)	12	14,29%
Total	84	100%



We can observe that the product with the worst value for money (the Beats headphones) is also the least preferred one. People seem to make a tradeoff between price and quality, and for an equal level of technology, they prefer to buy the cheapest product (in this case, the Sennheiser HD).
But they also pay attention to quality, and when the product provides premium features, they are prepared to pay a price: here, almost 40% of the people are likely to buy the Sennheiser Momentum headphones, which are very expensive (~300€). And almost a half will opt for the "cheap" product (Sennheiser HD).
If we look at the market shares in value, the gaps are actually increasing, and the roles of the premium and the cheap product are reversed. Now the premium product represents almost three quarters of the market value! And the share of the cheapest product (Sennheiser HD) sinks from a half to approximately 15%...
So even though the market shares (in volume) for the premium product are not the biggest, they are largely enough to ensure a very good margin, and a huge share of the market's value.



7. Conclusions

Even if people are very price sensitive (as shown in the importance plots), a good combination of technical features (frequency response, Bluetooth and noise cancelling for instance), can reeerse this trend at least partially, and lead to good sales, even for premium products. Moreover, premium dominate the market in terms of value.
Contrary to my first expectation, design does not play a huge role in the product evaluation. However, people have a slight preference for refined or old school headphones.

To better estimate which pairs of demographic groups shared the same priorities, and to better segement the population in the end, I computed the distance between between the groups' importances using a least squares function. For each group, I took the two other groups (of different type) that were the most similar to it.

	Students	Other occupations	12-25	25-40	40+	Women	Men
Students	0	0,098570015	0,003248954	0,024420056	0,099071119	0,002659366	0,003199682
Other occupations	0,098570015	0	0,07479045	0,060526862	0,10325815	0,097408038	0,06819259
12-25	0,003248954	0,07479045	0	0,018237592	0,077324771	0,007887309	0,000976304
25-40	0,024420056	0,060526862	0,018237592	0	0,039420502	0,022813843	0,013833378
40+	0,099071119	0,10325815	0,077324771	0,039420502	0	0,098396431	0,078643559
Women	0,002659366	0,097408038	0,007887309	0,022813843	0,098396431	0	0,006155949
Men	0,003199682	0,06819259	0,000976304	0,013833378	0,078643559	0,006155949	0
Closest other groups	Women/12-25	Men/25-40	Men/Student	Men/Student	Men/Student	Students/12-25	Student/12-25

So we can conclude that the character "Women" is strongly correlated[15] with the characters "Student" and "12-25". Same thing for "Men", "Student" and "12-25".

Consequently, we could target two different segments, which share the characters "Student" and "12-25":

- A "masculine segment": with a good frequency response, noise cancelling and a "Refined "design;
- A "feminine segment": with a less good frequency response, Bluetooth, a more reasonnable price, and an "Old school" design;

Of course this analysis was not perfect at all, it was undoubtedly full of bias (availability[16] bias, selection[17] bias). But despite all that, the data I collected allowed me to conduct an extended analysis with rigour and methodology, in order to make strategic choices. I discovered interesting an a little counterintuitive things during this study, and I think it brought me a lot.

[15] Indeed we can see redundance in the table for these features.
[16] Maybe people who love music were more likely to answer
[17] The broadcast medium I used (mainly social networks) just reached people like me, from the same social or cultural environment...