



The Business of Monitors

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Our Team

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Agenda

1 Project Goals

2 The Dataset

3 The Analysis

4 Results

**5 Recommendations
and Next Steps**

Project Goals

01

Project Goals

Client Request



Discover which monitor attributes are most important to consumers and evaluate the effect of a price increase on one of Dell's best-selling monitors

Execution

Utilize conjoint analysis to determine the most important monitor attributes and run a simulated market share analysis to evaluate elasticity



The Dataset

02

Survey Overview

385

Respondents

12

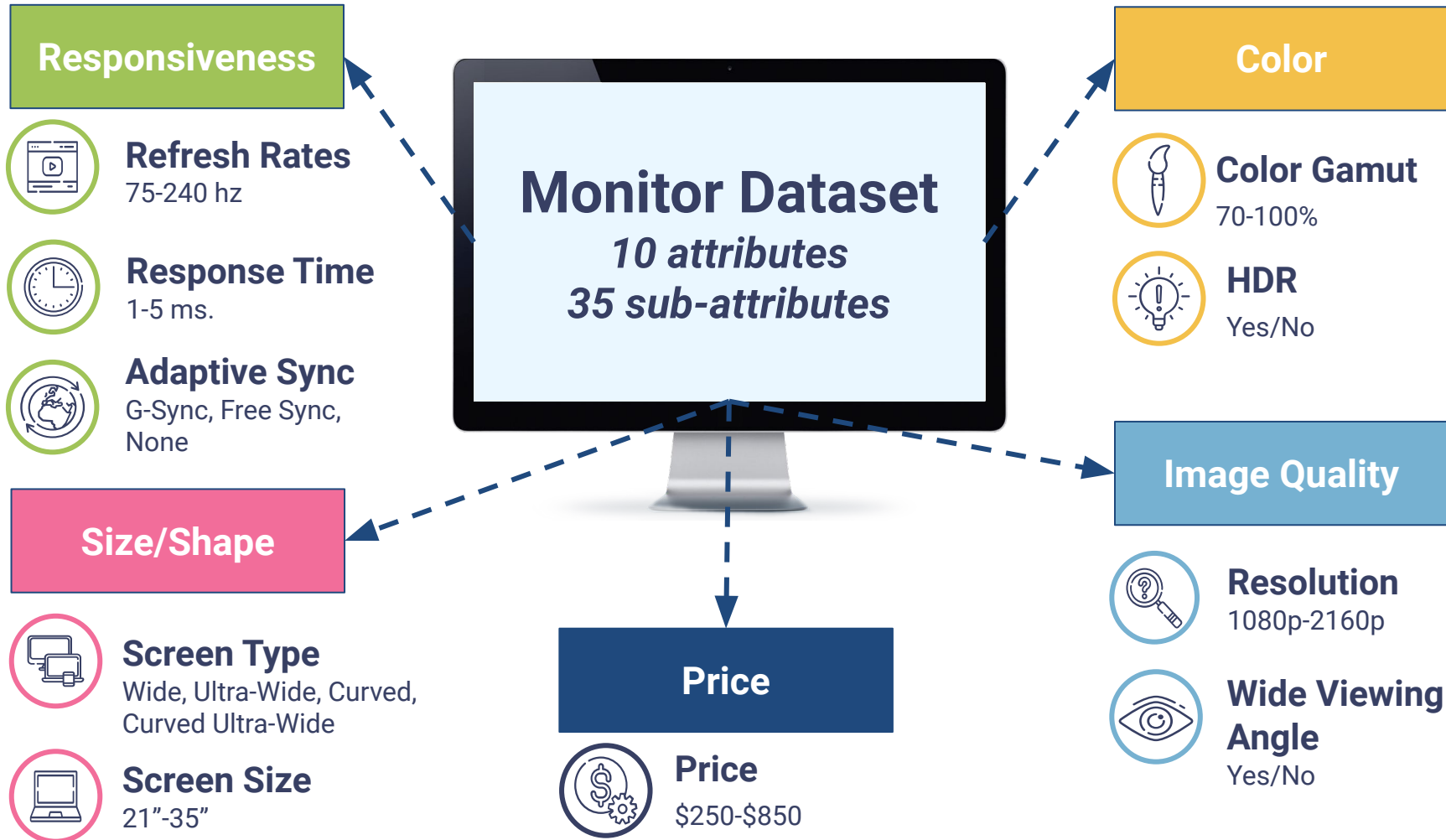
Tasks

10

Versions

4

Alternatives



The Analysis

03

Our Process



Conjoint Analysis - Overview

- **STEP 1:** Encode the quantitative variables as numeric values and qualitative variables as binary values
- **STEP 2:** Calculate the utility of buying and not buying
- **STEP 3:** Calculate the probability of buying and not buying
- **STEP 4:** Calculate the probability the predicted behavior = actual behavior (likelihood) and take the log
- **STEP 5:** Sum the log-likelihoods
- **STEP 6:** With solver, set a maximum constraint on the sum of the logs with the target variables and the intercept as inputs to find the weights of the variables

Model Selection

- **Linear (Figure 1)**
 - Numeric values were linearized i.e. screen size = 21"
- **Log-Transformed**
 - Screen size p-value > 0.05 so it was insignificant
 - Log transformed screen size variable to create significant variable
- **Binary (Figure 2)**
 - Screen size remained in binary form
 - All other variables remained linear because they continued being significant
 - Screen size became insignificant after 30"
 - Diminishing marginal return
 - As screen size increases, return does not increase

Model Selection

Figure 1

Source	Value	Pr > Chi ²
Intercept	-0.592	0.001
Ultra-Wide	-0.271	< 0.0001
Curved	-0.424	< 0.0001
Curved Ultra-Wide	-0.323	< 0.0001
Screen Size (in)	0.003	0.443
G-Sync	0.240	< 0.0001
Free-Sync	-0.062	0.228
1440p (2k / QHD)	0.269	< 0.0001
2160p (4k / UHD)	0.384	< 0.0001
Refresh Rate (hz)	0.005	< 0.0001
Wide Viewing Angle	0.080	0.048
Response Time (ms)	-0.183	< 0.0001
HDR	0.122	0.003
% Color Spectrum	0.838	< 0.0001
Price	-0.003	< 0.0001



Figure 2

Source	Value	Pr > Chi ²
Intercept	-0.507	0.001
Ultra-Wide	-0.366	< 0.0001
Curved	-0.428	< 0.0001
Curved Ultra-Wide	-0.374	< 0.0001
Screen Size 24"	0.278	< 0.0001
Screen Size 27"	0.286	< 0.0001
Screen Size 30"	0.099	0.119
Screen Size 35"	0.123	0.050
G-Sync	0.225	< 0.0001
Free-Sync	-0.060	0.242
1440p (2k / QHD)	0.262	< 0.0001
2160p (4k / UHD)	0.381	< 0.0001
Refresh Rate (hz)	0.005	< 0.0001
Wide Viewing Angle	0.041	0.327
Response Time (ms)	-0.180	< 0.0001
HDR	0.108	0.009
% Color Spectrum	0.790	< 0.0001
Price	-0.003	< 0.0001

Potential Reasons for Feature Insignificance

- **Screen Size**
 - Larger monitors potentially unnecessary or overwhelming
- **Adaptive Sync Technology**
 - Geared towards Gaming Industry
- **Wide Viewing Angles**
 - Greater priority for TV's
 - Usually one looks at a monitor straight on; a gimmick











Additional Analysis with Conjoint Results

- **Relative Value Analysis:** Compare the relative utility of each feature in each category to the base case to determine buyer preferences when given two features
- **Importance Analysis:** Calculate and contrast the importance of each category of features to buyers

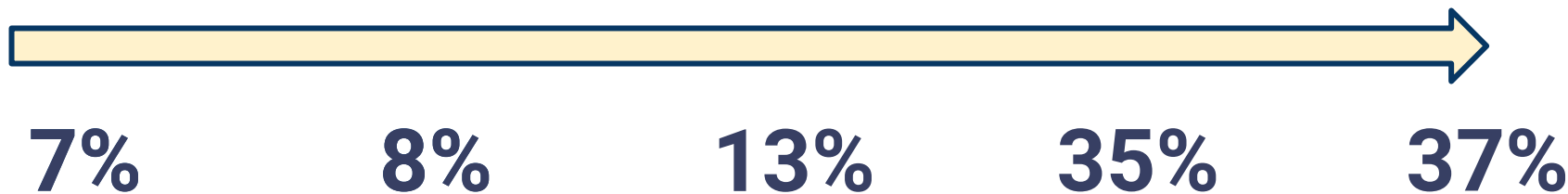
Results

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Relative Feature Importance

37%	Price		5%	Adaptive Sync	
16%	Refresh Rates		5%	Color Gamut	
14%	Response Time		5%	Screen Size	
8%	Screen Type		2%	HDR	
7%	Resolution		1%	Wide Viewing Angle	

Relative Category Importance



Color

Image Quality

Size/Shape

Responsiveness

Price



Color Gamut
(5%)



Resolution
(7%)



Screen Type
(8%)



Refresh Rates
(16%)



Price
(37%)



HDR
(2%)



Wide Viewing
Angle
(1%)



Screen Size
(5%)



Response Time
(14%)



Adaptive Sync
(5%)

The Upside of Upgrades

- Highest dollar value upgrades to customers are **refresh rate, response time, and resolution**



Resolution

↑ **+\$117** 2160p (4k/UHD)

+\$81 1440p (2k/QHD)

vs. 1080p (FHD)



Response Time

↑ **+\$222** (1 ms)

+\$111 (3 ms)

vs. 5 ms



Refresh Rate

↑ **+\$254** (240 hz)

+\$138 (165 hz)

+\$106 (144 hz)

+\$69 (120 hz)

vs. 75 hz

The Downside of Upgrades



Adaptive Sync

+\$69 (G-Sync)

-\$18 (Free-Sync)

vs. None



Screen Type

-\$115 (Curved Ultra-Wide)

-\$132 (Curved)

-\$113 (Ultra-Wide)

vs. Widescreen

- G-Sync is the most preferred type of adaptive sync, while customers would require an **\$18 subsidy** to accept **free-sync** over no sync
- Customers would require **subsidies of \$113-\$132** to accept a screen type **other than widescreen**

Market Share Analysis



Model 1
(\$250)



Model 2
(\$250)



Model 3
(\$400)



Model 4
(\$550)

Market Share Analysis

Feature	Model 1	Model 2	Model 3	Model 4
Screen Type	Widescreen	Widescreen	Curved	Curved Ultra-Wide
Screen Size	21"	24"	27"	35"
Adaptive Sync	None	None	Free-Sync	G-Sync
Resolution	1080p	1080p	1440p	1440p
Refresh Rate	75hz	120hz	144hz	100hz
Response Time	5ms	3ms	3ms	3ms
HDR	No	No	Yes	No
% Color Gamut	70%	85%	100%	85%
Price	\$250	\$250	\$400	\$550
Wide Viewing Angle	No	No	No	No

Market Share Analysis

					% Change	Elasticity
Price of Model 2	\$250	\$300	\$350	\$400	46%	
Model 1	10%	10%	11%	11%	11%	0.234
Model 2	27%	24%	21%	18%	-37%	-0.812
Model 3	19%	19%	20%	21%	11%	0.234
Model 4	9%	9%	9%	10%	11%	0.234
None	36%	38%	39%	40%	11%	0.234

Profit Analysis

Price	\$250	\$300	\$350	\$400
% of Market Share	27%	24%	21%	18%
Sales (Units)	132,815	117,577	103,593	90,877
Breakeven Volume	119,048	54,348	35,211	26,042
Fixed Cost	\$5,000,000	\$5,000,000	\$5,000,000	\$5,000,000
Unit Cost	\$208	\$208	\$208	\$208
% Margin	17%	31%	41%	48%
Profit	\$578,247	\$5,817,055	\$9,710,224	\$12,448,468

Profit Analysis

Total Market = 500,000

	% Margin
Product 1	26%
Product 3	14%
Product 4	11%



Recommendations and Next Steps

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Recommendations

New Models

When developing new monitors, prioritize features that have high utility for customers (eg. refresh rate and response time), and increase the ratio of widescreen monitors

Current Pricing

Dependant on competitive analysis, explore the possibility of increasing the price of Model 2

Next Steps

- Limitations: missing brand information, customer demographic information
- Variables of interest to include in future surveys: brand, panel technology (IPS vs TN vs LED), bezel, hdmi cable included, blue light, weight



Thank You

Any Questions?



The University of Texas at Austin
McCombs School of Business

Appendix

- Conjoint Analysis Steps (Detailed)
- Conjoint Analysis with Solver Steps
- Importance Analysis with Conjoint Results
- Relative Value Analysis with Conjoint Results

Steps for Conjoint Analysis

- **STEP 1:** Encode the quantitative variables as numeric values and qualitative variables as binary values
 - 1/numeric value = variable impacts buying outcome
 - 0 = variable has no impact on buying outcome
- **STEP 2:** Calculate the utility of buying (u_B) and not buying (u_D)
 - $u(B) = \text{SUMPRODUCT}(\text{Variable Weights: Survey Responses}) + \text{Intercept}$
 - $u(D) = 0$ because there is no utility of not buying

Steps for Conjoint Analysis

- **STEP 3:** Calculate the probability of buying (Prob(B)) and not buying (Prob(D))
 - $\text{Prob}(B) = \text{EXP}(u_B) / (\text{EXP}(u_B) + \text{EXP}(u_D))$
 - $\text{Prob}(D) = \text{EXP}(u_D) / (\text{EXP}(u_B) + \text{EXP}(u_D)) = 1 - \text{Prob}(B)$
- **STEP 4:** Calculate the probability the predicted behavior = actual behavior i.e. likelihood and take the log
 - $\text{Log-Likelihood} = \text{LN}(\text{Prob}(B)^{\text{Choice}} + \text{Prob}(D)^{(1-\text{Choice})})$
- **STEP 5:** Sum all the log-likelihoods

Conjoint Analysis with XLSTAT Solver

- **Process:** Allows user to set constraints on specific cells to find the optimal weights of target variables to reach a specified value, maximum, or minimum based on an equation
- **Equation:** $\text{Choice} = \text{Intercept} + b_1 \cdot \text{Ultra-Wide} + b_2 \cdot \text{Curved} + b_3 \cdot \text{Curved Ultra-Wide} + b_4 \cdot \text{Screen Size} + b_5 \cdot \text{G-Sync} + b_6 \cdot \text{Free-Sync} + b_7 \cdot 1440p + b_8 \cdot 2160p + b_9 \cdot \text{Refresh Rate} + b_{10} \cdot \text{Wide Viewing Angle} + b_{11} \cdot \text{Response Time} + b_{12} \cdot \text{HDR} + b_{13} \cdot \text{Color Spectrum} + b_{14} \cdot \text{Price}$
- **Goal:** Maximize the sum of log-likelihoods

Importance Analysis with Conjoint Results

- **Process:** Calculate and contrast the importance of each category of features to buyers
 - Identify the maximum and minimum utility of each feature in each category using the feature weights (b)
 - Calculate the difference between maximum and minimum utility
 - Find % importance by taking difference/sum of differences

Relative Value Analysis with Conjoint Results

- **Process:** Compare the relative utility of each feature in each category to the base case to determine buyer preferences when given two features
 - Calculate relative utility by taking the utility of the feature - utility of basecase feature
 - Take relative utility/price weight (b14)