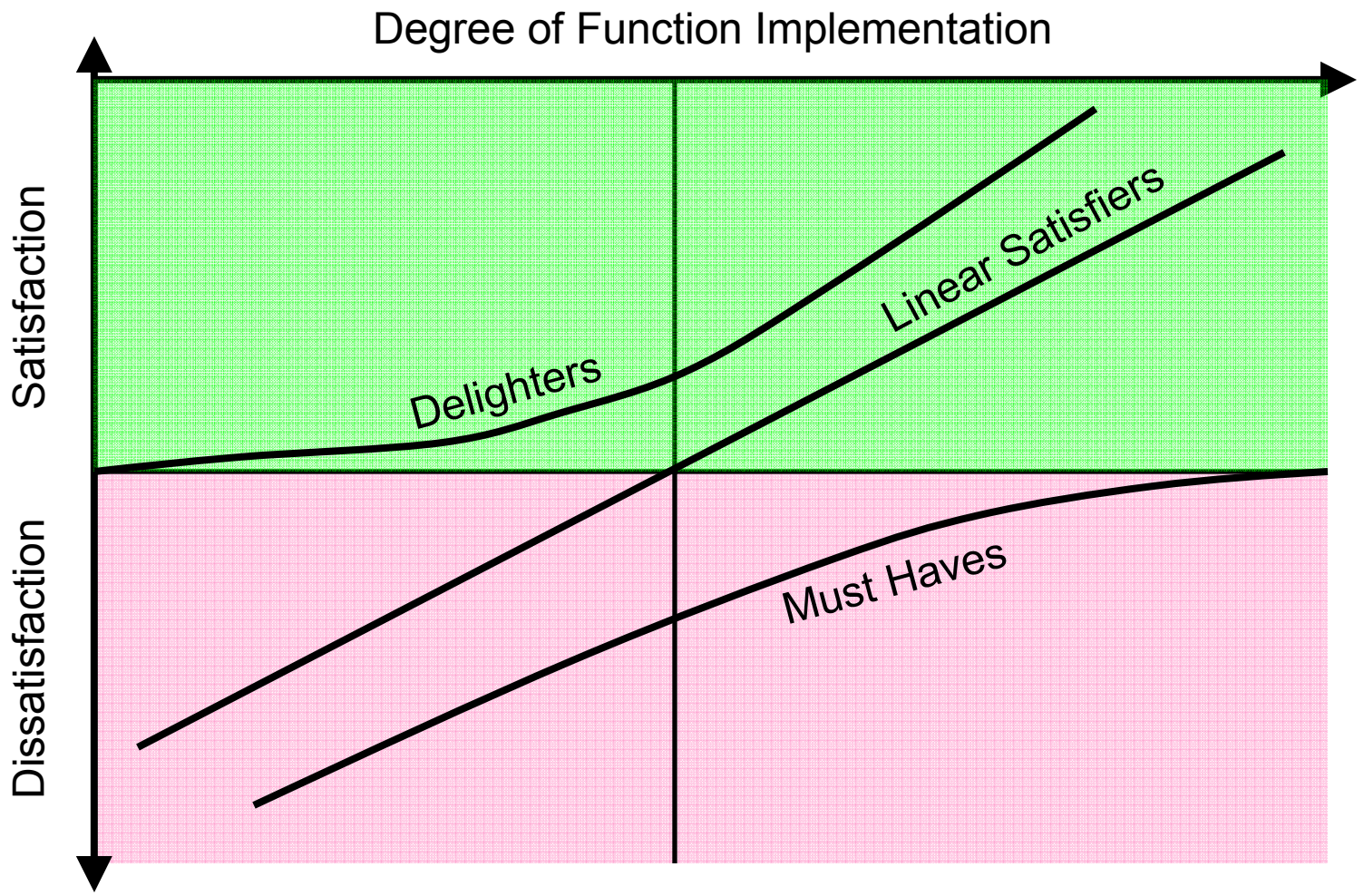
Structuring Needs

- Primary Needs (*Strategic Needs*)
- Secondary Needs (*Tactical Needs*)
- Tertiary Needs (*Operational Needs*)

- Must Haves
- Delighters (Latent Needs!)
- Linear Satisfiers
- Neutrals

Kano-Diagrams



Structuring Needs

A tendency that

- Customers sort needs more evenly
- Customer ordering reflects actual use
- Group ordering reflects engineering view

- Professional teams only slightly outperform students

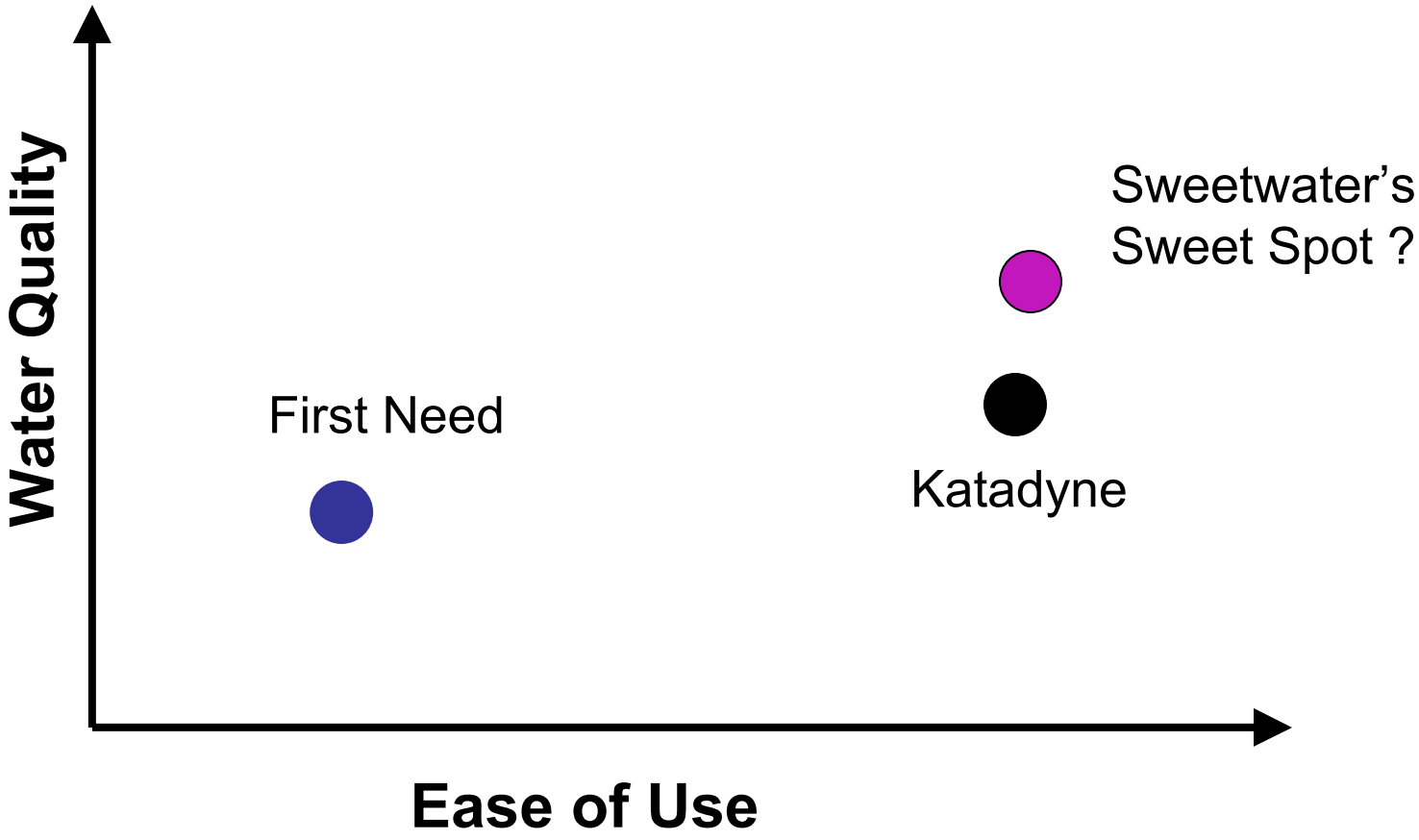
Customer Needs Process

- Define the Scope
  - Mission Statement
- Gather Raw Data
  - Observation
  - Interviews
  - Focus Groups
- Interpret Raw Data
  - Need Statements
- Organize the Needs
  - Hierarchy
- Establish Importance
  - Surveys
- Reflect on the Process
  - Continuous Improvement

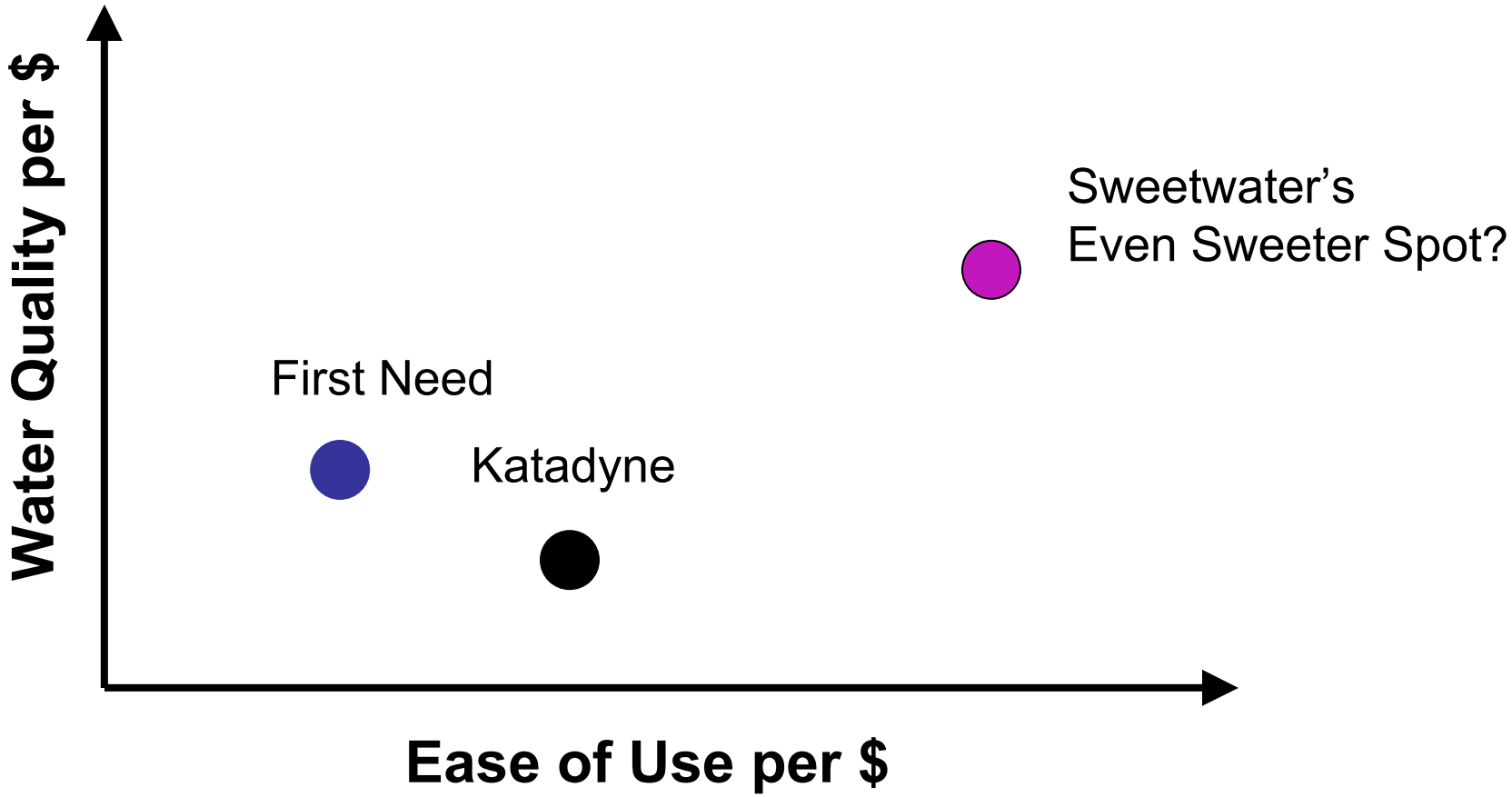
Importance Surveys

- 5,7,9 – point direct rating
  - How important is feature?
  - Desirable, neutral, undesirable
- Constant Sum Scale
  - Allocating fixed number of points to need levels
- Anchored Scale
  - Attach 10 points to most important need
  - Up to 10 points to all others
- All seem to perform equally well
- Frequency of mentioning a need is usually NOT a good measure for the importance of need

Perceptual Map



Normalized Perceptual Map



A Moment In The Mind of Customer Matt K.

Matt K's Profile

- Matt is an outdoor enthusiasts, who frequently hikes and cycles, both alone or with his family of four. Being ranked among the top 10 cyclists in the United States, he puts great emphasis on staying healthy and having the right gear. Especially during racing season, he cannot afford the hassles of contaminated water and therefore always carries his water filter with him. However, since his hikes are mainly day hikes, overall usage of the water filter is limited.

- As a successful designer of new products, who runs his own company and who teaches at two of the most prestigious institutions in the country, he is very demanding on the products he purchases and is often an opinion leader heard on the internet and among his friends, acquaintances and business contacts.

- Enjoying a great deal of financial freedom, he only purchases products that truly impress him and whose functionality is at their core. He favors air cooled Porsches and original Land Rovers over designs from Versace or Graves.

- In summary, Matt K. can be considered a typical "high end" customer for water filters with great influence among his peers.

- So what is going on in his brain?

Evaluating Products

- Products are Bundles of Attributes
- Buyers assign Values to the Realization of these Attributes
- Buyers combine Attribute Values to Generate Product Values

Water Filter Example

- 4 Attributes
- 3 Levels Each
- Each Level has a (Part Worth) Utility

Pump Rate	Utility		Weight	Utility
0.8 l/min	- 0.71		8 oz	4.05
1.3 l/min	0.00		12 oz	0.05
2.0 l/min	0.71		16 oz	-4.00
Pump Force	**Utility**		**Price**	**Utility**
1.5 lbs	1.29		$ 40	0.33
5.0 lbs	0.33		$ 50	0.29
9.0 lbs	-1.62		$ 70	-0.62

Interpreting Utilities

- Utility of 1.3 l/min, 8 oz, = 0.00 +0.33 + 4.05 + 0.33 = 4.71
- Utility of 1.3 l/min, 1.5 lbs, 8 oz, $70 = 0.00 +1.29 + 4.05 - 0.62 = 4.72

Pump Rate	Utility
0.8 l/min	- 0.71
1.3 l/min	0.00
2.0 l/min	0.71

Weight	Utility
8 oz	4.05
12 oz	0.05
16 oz	-4.00

Pump Force	Utility
1.5 lbs	1.29
5.0 lbs	0.33
9.0 lbs	-1.62

Price	Utility
$ 40	0.33
$ 50	0.29
$ 70	-0.62

All others equal, dropping the required force from 5.0 lbs to 1.5 lbs is worth $30 !!!

- Attribute Importance (Range)
  - Pump Rate: 0.71 – (-0.71) = 1.42 10.6 %
  - Pump Force: 1.20 – (-1.62) = 2.82 21.3 %
  - Weight: 4.05 – (-4.00) = 8.05 60.8 %
  - Price: 0.33 – (-0.62) = 0.95 7.2 %

13.24 100 %

Conjoint Analysis…

…attempts to determine the **relative importance** consumers attach to the salient **attributes** and the **utilities** they attach to the **levels of attributes**

Terminology

- Attributes
  - Important Product Characteristics
  - Power, Brand, Looks, Price …
- Levels
  - Quantities or Qualities of Attributes
  - 375W, 600W, 780W - Kitchen Aid, De Longhi, Bosch - contemporary, traditional, plain - $250, $370, $450
- Utility (of a Level)
  - Numbers that express the value customers place on each level
- Stimulus
  - A representation of a product
    - Described by its attributes on index cards
    - Pictures, Prototypes

Example: Water Filter

- Attributes and Levels
  - Relevant Attributes from Qualitative Research
    - Flow Rate (0.8, 1.3, 2.0 l/min)
    - Required Pumping Force (1.5, 5, 9 lbs)
    - Price ($40, $60, $80)

		Levels		
		1	2	3
Attributes	1 [l/m]	0.8	1.3	2.0
	2 [lbs]	1.5	5.0	9.0
	3 [$]	40	60	80

The Model

$$U(X) = \sum_{i=1}^{m} \sum_{j=1}^{k_i} a_{ij} x_{ij}$$

- $U(X)$ = Overall Utility of an Alternative
- a_{ij} = Utility of Level *j* of Attribute *i*
- k_i = Number of Levels of Attribute *i*
- m = Number of Attributes
- x_{ij} = 1 if Level *j* of Attribute *i* is present
  0 otherwise

The Model: Example

$$f(X) = \sum_{i=1}^{m} \sum_{j=1}^{k_i} a_{ij} x_{ij}$$

		Levels		
		1	2	3
Attributes	1 [l/m]	0.8	1.3	2.0
	2 [lbs]	1.5	5.0	9.0
	3 [$]	40	60	80

$$x_{1,1} = 1 \quad x_{2,1} = 0 \quad x_{3,1} = 0$$
$$x_{1,2} = 0 \quad x_{2,2} = 1 \quad x_{3,2} = 0$$
$$x_{1,3} = 0 \quad x_{2,3} = 1 \quad x_{3,3} = 0$$

Stimuli (Profiles)

Profile #	Flow rate	Force	Price	Rating
1	0.8	1.5	40	
2	0.8	5.0	60	
3	0.8	9.0	80	
4	1.3	1.5	60	
5	1.3	5.0	80	
6	1.3	9.0	40	
7	2.0	1.5	80	
8	2.0	5.0	40	
9	2.0	9.0	60	

Fractional Factorial Design from Standard Table

Rate these profiles from
1 “extremely unlikely to buy” to
7 “extremely likely to buy”

Stimuli (Profiles)

Profile #	Flow rate	Force	Price	Rating
1	0.8	1.5	40	3
2	0.8	5.0	60	2
3	0.8	9.0	80	1
4	1.3	1.5	60	4
5	1.3	5.0	80	2
6	1.3	9.0	40	3
7	2.0	1.5	80	4
8	2.0	5.0	40	6
9	2.0	9.0	60	4

Rate these profiles from
1 “extremely unlikely to buy” to
7 “extremely likely to buy”

Dummy Variable Regression

$$U = b_0 + \sum_{i=1}^{m} \sum_{j=1}^{k_i - 1} b_{ij} X_{ij}$$

- X_{ij} = Dummy Variable for Level *j* of Attribute *i* ($i = 1,\ldots,k_i-1$)
- U = Estimated Utility
- b_0, b_{ij} = Regression Coefficients

Dummy Variable Regression

$$U = b_0 + \sum_{i=1}^{m} \sum_{j=1}^{k_i - 1} b_{ij} X_{ij}$$

- X_{ij} = Dummy Variable for Level *j* of Attribute *i* ($i = 1,\ldots,k_i-1$)
- U = Estimated Utility
- b_0, b_{ij} = Regression Coefficients

$$U(X) = \sum_{i=1}^{m} \sum_{j=1}^{k_i} a_{ij} x_{ij}$$

Dummy Representation of Profiles

Profile #	Flow rate [l/min]		Force [lbs]		Price [$]		Rating
	0.8	1.3	1.5	5.0	40	60	
1	1	0	1	0	1	0	3
2	1	0	0	1	0	1	2
3	1	0	0	0	0	0	1
4	0	1	1	0	0	1	4
5	0	1	0	1	0	0	2
6	0	1	0	0	1	0	3
7	0	0	1	0	0	0	4
8	0	0	0	1	1	0	6
9	0	0	0	0	0	1	4

Profile #	Flow rate	Force	Price	Rating
1	0.8	1.5	40	3
2	0.8	5.0	60	2
3	0.8	9.0	80	1
4	1.3	1.5	60	4
5	1.3	5.0	80	2
6	1.3	9.0	40	3
7	2.0	1.5	80	4
8	2.0	5.0	40	6
9	2.0	9.0	60	4

Calculating Utilities

Flow Rate [l/min]	0.8	$b_{11} = -2.67$	a_{11} =?
	1.3	$b_{12} = -1.67$	a_{12} =?
	2.0	---	a_{13} =?
Force [lbs]	1.5	$b_{21} = 1.00$	a_{21} =?
	5.0	$b_{22} = 0.67$	a_{22} =?
	9.0	---	a_{23} =?
Price [$]	40	$b_{31} = 1.67$	a_{31} =?
	60	$b_{32} = 1.00$	a_{32} =?
	80	---	a_{33} =?

- 2.67 is a measure for the "distance" of flow rate 0.8 to the "default" flow rate of 2.0.

Thus
$a_{1,1} - a_{1,3} = b_{1,1} = -2.67$

Generally:

$$a_{i,j} - a_{i,k_i} = b_{i,j} \quad \text{for all } i \text{ and } j = 1,\ldots, k_i - 1$$

Calculating Utilities

Flow Rate [l/min]	0.8	$b_{11} = -2.67$	$a_{11} - a_{13} = b_{11}$
	1.3	$b_{12} = -1.67$	$a_{12} - a_{13} = b_{12}$
	2.0	---	$a_{13} = ?$
Force [lbs]	1.5	$b_{21} = 1.00$	$a_{21} - a_{23} = b_{21}$
	5.0	$b_{22} = 0.67$	$a_{22} - a_{23} = b_{22}$
	9.0	---	$a_{23} = ?$
Price [$]	40	$b_{31} = 1.67$	$a_{31} - a_{33} = b_{31}$
	60	$b_{32} = 1.00$	$a_{32} - a_{33} = b_{32}$
	80	---	$a_{33} = ?$

3 equations with 2 unknowns.

We need one more equation.

Since we are only interested in difference of utility, we can set

$a_{1,1} + a_{1,1} + a_{1,3} = 0$

Generally: $\sum_j a_{i,j} = 0$ for all attributes i

Calculating Utilities

Flow Rate [l/min]	0.8	$b_{11} = -2.67$	$a_{11} - a_{13} = b_{11}$
	1.3	$b_{12} = -1.67$	$a_{12} - a_{13} = b_{12}$
	2.0	---	$a_{11} + a_{12} + a_{13} = 0$
Force [lbs]	1.5	$b_{21} = 1.00$	$a_{21} - a_{23} = b_{21}$
	5.0	$b_{22} = 0.67$	$a_{22} - a_{23} = b_{22}$
	9.0	---	$a_{21} + a_{22} + a_{23} = 0$
Price [$]	40	$b_{31} = 1.67$	$a_{31} - a_{33} = b_{31}$
	60	$b_{32} = 1.00$	$a_{32} - a_{33} = b_{32}$
	80	---	$a_{31} + a_{32} + a_{33} = 0$

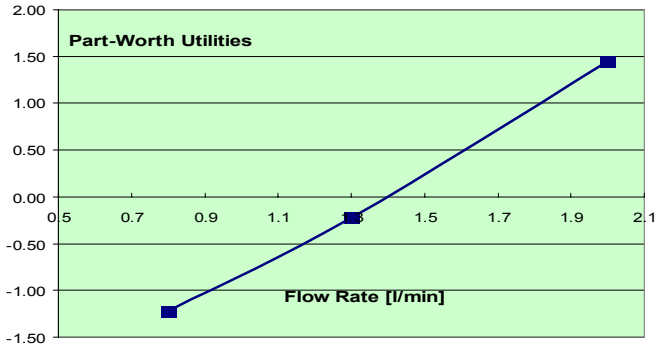
Generally: $\sum_{j} a_{ij} = 0$ for all attributes i

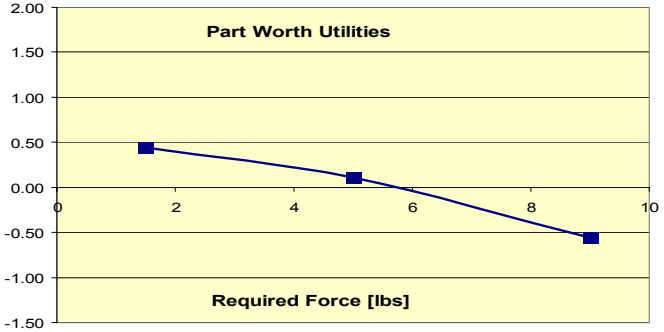
Calculating Utilities

Flow Rate [l/min]	0.8	$b_{11} = -2.67$	$a_{11} - a_{13} = b_{11}$	$a_{11} = -1.22$
	1.3	$b_{12} = -1.67$	$a_{12} - a_{13} = b_{12}$	$a_{12} = -0.22$
	2.0	---	$a_{11} + a_{12} + a_{13} = 0$	$a_{13} = 1.44$
Force [lbs]	1.5	$b_{21} = 1.00$	$a_{21} - a_{23} = b_{21}$	$a_{21} = 0.44$
	5.0	$b_{22} = 0.67$	$a_{22} - a_{23} = b_{22}$	$a_{22} = 0.11$
	9.0	---	$a_{21} + a_{22} + a_{23} = 0$	$a_{23} = -0.56$
Price [$]	40	$b_{31} = 1.67$	$a_{31} - a_{33} = b_{31}$	$a_{31} = 0.78$
	60	$b_{32} = 1.00$	$a_{32} - a_{33} = b_{32}$	$a_{32} = 0.11$
	80	---	$a_{31} + a_{32} + a_{33} = 0$	$a_{33} = -0.89$

Part Worth Utilities

Flow Rate [l/min]	0.8	$a_{11} = -1.22$
	1.3	$a_{12} = -0.22$
	2.0	$a_{13} = 1.44$
Force [lbs]	1.5	$a_{21} = 0.44$
	5.0	$a_{22} = 0.11$
	9.0	$a_{23} = -0.56$
Price [$]	40	$a_{31} = 0.78$
	60	$a_{32} = 0.11$
	80	$a_{33} = -0.89$





Attribute Importance

			Range
Flow Rate [l/min]	0.8	$a_{11} = -1.22$	1.44 + 1.22 = 2.67
	1.3	$a_{12} = -0.22$	
	2.0	$a_{13} = 1.44$	
Force [lbs]	1.5	$a_{21} = 0.44$	0.11 + 0.56 = 0.67
	5.0	$a_{22} = 0.11$	
	9.0	$a_{23} = -0.56$	
Price [$]	40	$a_{31} = 0.78$	0.78 + 0.89 = 1.67
	60	$a_{32} = 0.11$	
	80	$a_{33} = -0.89$	
			5.00

Attribute Importance

			Range	Weight
Flow Rate [l/min]	0.8	a_{11} = -1.22	1.44 + 1.22 = 2.67	2.67/5 = 53.3%
	1.3	a_{12} = -0.22		
	2.0	a_{13} = 1.44		
Force [lbs]	1.5	a_{21} = 0.44	0.11 + 0.56 = 0.67	0.67/5 = 13.3%
	5.0	a_{22} = 0.11		
	9.0	a_{23} = -0.56		
Price [$]	40	a_{31} = 0.78	0.78 + 0.89 = 1.67	1.67/5 = 33.3%
	60	a_{32} = 0.11		
	80	a_{33} = -0.89		
			5.00	100%

Utilities

Flow Rate [l/min]	0.8	$a_{11} = -1.22$
	1.3	$a_{12} = -0.22$
	2.0	$a_{13} = 1.44$
Force [lbs]	1.5	$a_{21} = 0.44$
	5.0	$a_{22} = 0.11$
	9.0	$a_{23} = -0.56$
Price [$]	40	$a_{31} = 0.78$
	60	$a_{32} = 0.11$
	80	$a_{33} = -0.89$

$$u(X) = \sum_{i=1}^{m} \sum_{j=1}^{k_i} a_{ij} x_{ij}$$

Utilities for **ALL** Designs

Feature	0.8 l/m	1.3 l/m	2 l/m	1.5 lbs	5 lbs	9 lbs	$40	$60	$80	
Part Utilities	-1.22	-0.22	1.44	0.44	0.11	-0.56	0.78	0.11	-0.89	
Designs										**Total Utility**
1	1			1			1			**0.00**
2	1			1				1		**-0.67**
3	1			1					1	**-1.67**
4	1				1		1			**-0.33**
5	1				1			1		**-1.00**
6	1				1				1	**-2.00**
7	1					1	1			**-1.00**
8	1					1		1		**-1.67**
9	1					1			1	**-2.67**
10		1		1			1			**1.00**
11		1		1				1		**0.33**
12		1		1					1	**-0.67**
13		1			1		1			**0.67**
14		1			1			1		**0.00**
15		1			1				1	**-1.00**
16		1				1	1			**0.00**
17		1				1		1		**-0.67**
18		1				1			1	**-1.67**
19			1	1			1			**2.67**
20			1	1				1		**2.00**
21			1	1					1	**1.00**
22			1		1		1			**2.33**
23			1		1			1		**1.67**
24			1		1				1	**0.67**
25			1			1	1			**1.67**
26			1			1		1		**1.00**
27			1			1			1	**0.00**

Utilities for **ALL** Designs

Feature	0.8 l/m	1.3 l/m	2 l/m	1.5 lbs	5 lbs	9 lbs	$40	$60	$80	
Part Utilities	-1.22	-0.22	1.44	0.44	0.11	-0.56	0.78	0.11	-0.89	
Designs										**Total Utility**
19			1	1			1			**2.67**
22			1		1		1			**2.33**
20			1	1				1		**2.00**
25			1			1	1			**1.67**
23			1		1			1		**1.67**
10		1		1			1			**1.00**
21			1	1					1	**1.00**
26			1			1		1		**1.00**
13		1			1		1			**0.67**
24			1		1				1	**0.67**
11		1		1				1		**0.33**
1	1			1			1			**0.00**
16		1				1	1			**0.00**
27			1			1			1	**0.00**
14		1			1			1		**0.00**
4	1				1		1			**-0.33**
2	1			1				1		**-0.67**
12		1		1					1	**-0.67**
17		1				1		1		**-0.67**
7	1					1	1			**-1.00**
5	1				1			1		**-1.00**
15		1			1				1	**-1.00**
3	1			1					1	**-1.67**
8	1					1		1		**-1.67**
18		1				1			1	**-1.67**
6	1				1				1	**-2.00**
9	1					1			1	**-2.67**

Utilities of Top Designs

Feature	0.8 l/m	1.3 l/m	2 l/m	1.5 lbs	5 lbs	9 lbs	$40	$60	$80	
Part Utilities	-1.22	-0.22	1.44	0.44	0.11	-0.56	0.78	0.11	-0.89	
Designs										**Total Utility**
19			1	1			1			**2.67**
22			1		1		1			**2.33**
20			1	1				1		**2.00**
						1	1			**1.67**
								1		**1.67**
10		1		1			1			**1.00**
21			1	1					1	**1.00**
26			1			1		1		**1.00**
13		1			1		1			**0.67**
24			1		1				1	**0.67**
11		1		1				1		**0.33**

9.0 lbs at $40 has the same utility as 5.0 lbs at $60

Utilities of Top Designs

Feature	0.8 l/m	1.3 l/m	2 l/m	1.5 lbs	5 lbs	9 lbs	$40	$60	$80	
Part Utilities	-1.22	-0.22	1.44	0.44	0.11	-0.56	0.78	0.11	-0.89	
Designs										**Total Utility**
19			1	1			1			**2.67**
22			1		1		1			**2.33**
20			1	1				1		**2.00**
25			1			1	1			**1.67**
23			1		1			1		**1.67**
10		1		1			1			**1.00**
									1	**1.00**
								1		**1.00**
13		1			1		1			**0.67**
24			1		1				1	**0.67**
11		1		1				1		**0.33**

9.0lbs at $60 has the same utility as 1.5lbs at $80

Utilities of Top Designs

Feature	0.8 l/m	1.3 l/m	2 l/m	1.5 lbs	5 lbs	9 lbs	$40	$60	$80	
Part Utilities	-1.22	-0.22	1.44	0.44	0.11	-0.56	0.78	0.11	-0.89	
Designs										**Total Utility**
19			1	1			1			**2.67**
22			1		1		1			**2.33**
20			1	1				1		**2.00**
25			1			1	1			**1.67**
23			1		1			1		**1.67**
1.3 l/min at $40 has the same utility as 2.0 l/min at $80							1			**1.00**
									1	**1.00**
26			1			1		1		**1.00**
1.3 l/min at $40 has the same utility as 2.0 l/min at $80							1			**0.67**
									1	**0.67**
11		1		1				1		**0.33**

Applications for Conjoint Analysis

- Product or Service “Optimization”
  - Customer Trade-Offs
  - Market Share of Different Designs
- Segmentation
  - Identification of Customer Groups
  - Cluster Analysis
- Product Line “Optimization”
  - Cannibalization of Existing Products
- Attribute Importance Measurement
  - Focus of PD Efforts
  - i.e. Flow Rate, Pumping Force

Caveats: Special Effects

- Interactions
  - Chocolate (good) + Oysters (good) = BAD
- Alternative Specific Effects
  - Interactions
  - Alternative specific ranges
    - 18 hours travel time: Sydney good, Miami bad
  - Alternative specific Occurrences
    - Bus vs. Car: Waiting, no waiting
- Cross Effects
  - Lexus Entry: Reduction of Utility of Mercedes vs. Kia
- Attribute Utilities
  - Across attributes, utility levels are meaningless
    - “2.0 l/min” (0.71) better than “$ 40” (0.33) ???

Types of Conjoint Analysis

- Distinguished by: Experimental Design, Stimulus, Statistical Analysis, Simulation Modeling
- Traditional Full Profile Conjoint Analysis
  - "Poor Man's Choice"
  - No Special Software Needed
  - No Special Effects (Interaction Possible)
  - DOE Catalogues
  - Limited Number of Profiles
- Adaptive Conjoint Analysis (ACA)
  - "Practitioner's Choice"
  - Fully Software Controlled
  - Generates Paired Comparisons
  - Up to 30 Attributes
  - No Special Effects
- Choice-Based Conjoint Analysis
  - "Academic's Choice"
  - Concurrent Design of Choice Sets and Profiles
- Availability Experiments
  - Cross Effects
- Best/Worst Conjoint Analysis
  - Choice *Within* a Profile
  - Attribute Utility
- Partial Profile Choice Experiments (PPCE)
  - Up to 100 Attributes
  - Only Partial Profiles Evaluated

Next Tuesday

- First Team Homework Due in Class
  - Mission Statement, List of Structured Customer Needs, Process Report, Original Proposal Sheet
- Combine Homework in PowerPoint File
  - You may be ask to present you work in class
- Hand In THREE Hardcopies
- Upload PowerPoint File to SloanSpaces
- Matt is Teaching

Company Update

- Introduced in August 1993
- 1994, SW shipped ~54,000 units
- 1994 Revenue of $2 million
- MSR (REI-owned!) enters market before SW and takes 40% of market share
- US Army shows interest
- 1997, SW almost disappears?
- 1998, Cascade Design [CD] acquires SW
  - CD had previously (1996) bought Platypus
- 2001, CD buys MSR
  - Sweetwater name on MSR products
  - Sweetwater is still household name

Take Aways

- Capture “What, Not How”
- Meet customers in the use environment
- Collect visual, verbal, and textual data
- Props will stimulate customer responses.
- Interviews are more efficient than focus groups
- Interview all stakeholders and lead users
- Develop an organized list of need statements
- Look for latent needs
- Make a video to communicate results
- Survey and Conjoint Analysis to quantify tradeoffs