Conjoint Analysis

- Brand
- Weight
- Brightness
- Resolution
- Display
- Price

Conjoint analysis is a technique used in product development, to determine how customers value different features that make up an individual product or service.

Conjoint Analysis

- Based on the notion that consumers evaluate products by assessing the value (utility) of its separate (yet conjoined) parts.

- Estimates
  - relative importance consumers place on a product's qualities or attributes.
  - value they attach to the various levels of each attribute (part worth).

- Understanding of attribute importance and product utility helps marketers develop products, segment markets and refine marketing mix.

Product Attributes – Shampoo, Detergent, Car, Shaving System

Product development often entails trade off between various attributes / features

- Car
  - Engine capacity
  - Power
  - Manoeuvrability
  - Fuel efficiency
  - Safety
  - Comfort
  - Body and style
  - Price
- Shaving System
  - No of blades
  - Longevity
  - Smoothness of shave
  - Mounting
  - Lubrication
  - Price
- Shampoo
  - Cleans
  - Conditions
  - Treatment
  - Anti-dandruff
  - Nourishment
  - Price
- Detergent
  - Cleaning (Active Detergent)
  - Concentration
  - Stain removal
  - Longevity
  - Scent
  - Protects clothes / colours
  - Softens
  - Price

Conjoint Analysis – Steps

1. Identify the key **attributes** of a product (or service) … and their realistic (i.e. actual) **levels** (range of values)
2. Vast number of product possibilities are reduced to limited number of **product profiles** assuming pair-wise independence
3. Depict product profiles as product offers in a manner that enables respondents to assess these profiles
4. Respondents rate each profile on a scale of (usually a large scale is used 0 to 10 for 16 or fewer profiles … expanded to 21 for more than 16 profiles). (Ranking is more rigorous, but also more time consuming.)
5. For each respondent, compute **utility function** for each attribute and **part-worth** for each level
6. Compute average part-worth across respondents. Determine **attribute importance**
7. Individual utility functions / part worth used for running **simulations**

Portable Projectors

Product Attributes

- Brand
- Weight
- Brightness
- Resolution
- Price
- Display Technology

Portable Projectors – Product Bundle or Profile

Attributes	Product Profile
Brand	InFocus
Weight (kg)	1.2 kg
Brightness (lumens)	2000
Resolution	1280×800
Display Technology	DLP
Price	$1200

Portable Projectors – Attributes & Levels

Attributes	Levels				Product Profile
Brand	Epson	Dell	InFocus	Optoma	InFocus
Weight (kg)	1.2 kg		1.8 kg	2.4 kg	1.2 kg
Brightness (lumens)	1000		2000	3000	2000
Resolution	1280 × 800		1024 × 768		1280 × 800
Display Technology	DLP		LCD		DLP
Price	$1200		$600		$1200

Total of 288 (4×3×3×2×2×2) product possibilities. Too many options for respondents to rank. These possibilities, however, can be reduced to 11 by assuming pair-wise independence.

Pairwise independent

- InFocus, DLP ✓
- Epson, DLP

- InFocus, LCD ✓
- Epson, LCD

This is an example of pairwise independence. Irrespective of projector technology, InFocus is preferred over Epson.

This assumption allows for the reduction in number of profiles from 288 to 11

Pairwise dependent

- InFocus, DLP ✓
- Epson, DLP

- InFocus, LCD
- Epson, LCD ✓

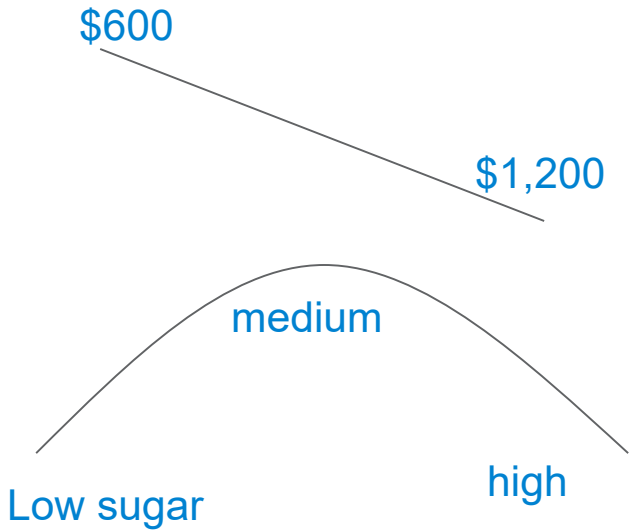
Pairwise dependence occurs when we have *interaction effects* i.e. the rating of an attribute is dependent on the value of another. Epson has higher part worth than InFocus if display is LCD, and lower if it is DLP.

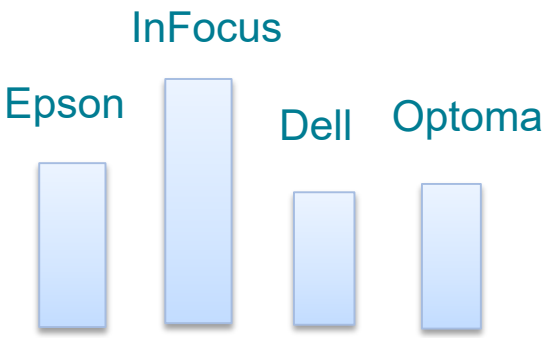
Conjoint Analysis – Steps

1. Identify the key **attributes** of a product (or service) … and their realistic **levels** (range of values)
2. Vast number of product possibilities are reduced to limited number of **product profiles** assuming pair-wise independence
3. Depict product profiles as product offers in a manner that enables respondents to assess these profiles
4. Respondents **rate each profile** on a scale of (usually a large scale is used 0 to 10 for fewer profiles … expanded to 0-100 for larger number of profiles). (Ranking is more rigorous, but also more time consuming).
5. For each respondent, compute **utility function** for each attribute and **part-worth** for each level.
6. Compute average part-worth across respondents. Determine **attribute importance**
7. Individual utility functions / part worth used for running **simulations**

Utility function – various approaches

- **Linear** models assume a straight-line relationship ... as might be appropriate for price
- **Ideal-point** or quadratic models (inverted U-shaped curves) are appropriate when consumers have a preference for a specific level … as might be the case for level of carbonation or sweetness in soft drinks
- **Part-worth** model estimates part-worth that survey respondents place on each individual level of a particular attribute. Appropriate for qualitative features such as brand or colour





Part-worth and relative importance for portable projectors

Average score across respondents

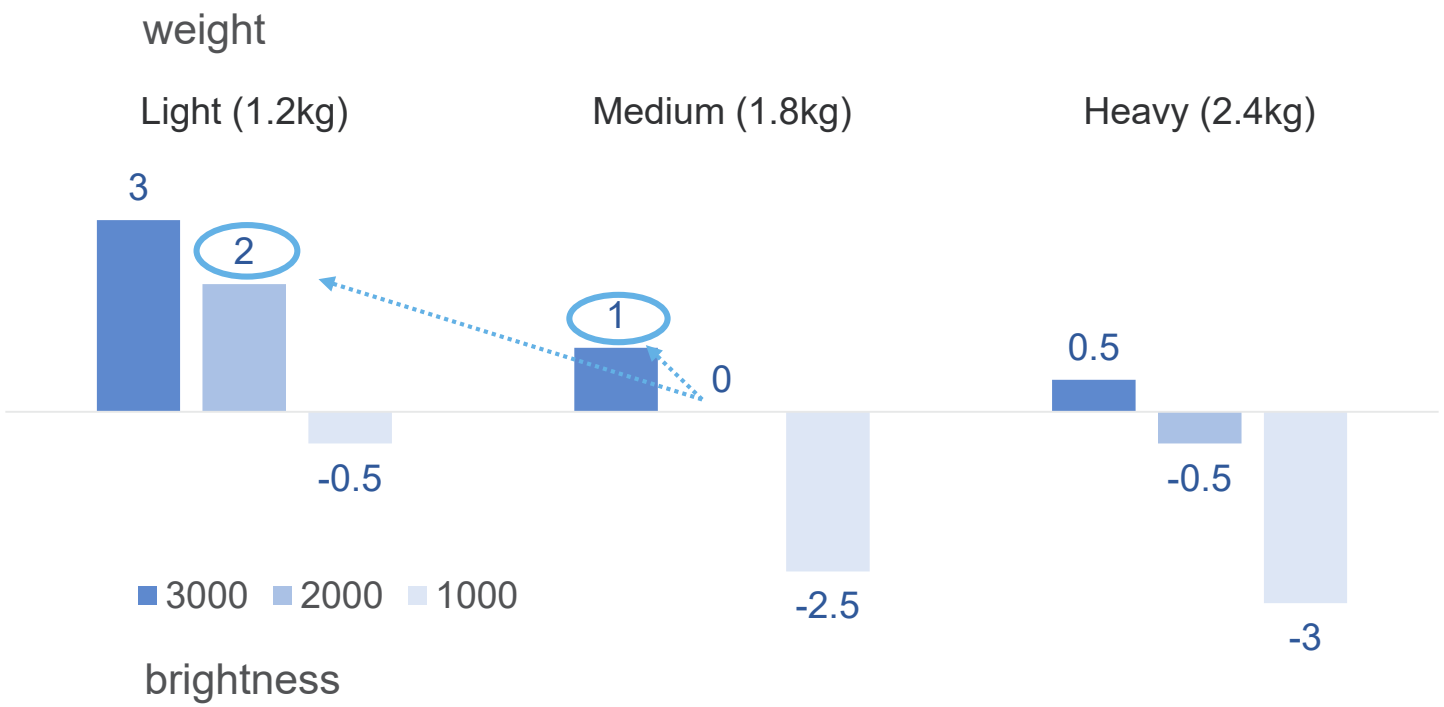
Attributes	Levels	Part-Worth	Importance	Relative Importance %
Brand	Epson	1.50	5.15	26.4
	Dell	-1.35		
	InFocus	2.50		
	Optoma	-2.65		
Weight	1.2 kg	1.50	2.50	12.8
	1.8 kg	-0.50		
	2.4 kg	-1.00		
Brightness	1000 lumens	-2.00	3.48	17.8
	2000 lumens	0.52		
	3000 lumens	1.48		
Resolution	1280 x 800	1.89	3.78	19.4
	1024 x 768	-1.89		
Technology	DLP	0.78	1.56	8.0
	LCD	-0.78		
Price	$1,200	-1.53	3.06	15.7
	$600	1.53		
Total			19.53	100.0

Attribute importance = range (max - min part-worth)
Relative importance is percentage of total importance scores

Trade-Off

Example: making trade-off between **brightness** and **weight**

Question: Do we stand to gain more utility by increasing brightness or by reducing weight of projector. (Current offer is 2000 lumens, 1.8 kg weight)



Attributes	Levels	Part-Worth
Weight	1.2 kg	1.5
	1.8 kg	**-0.5**
	2.4 kg	-1.0
Brightness (lumens)	3000	1.5
	2000	**0.5**
	1000	-2.0

Answer

Reduce Weight. Utility improves by +2 if we reduce weight to 1.2kg compared to +1 if we improve brightness to 3000.

Trade-Off

Example: making trade-off between **brightness** and **weight**

Questions:

1. A 3000 lumens projector is three times more attractive compared to a 2000 lumens projector? True/False
2. Weight reduction (1.8kg to 1.2kg) is 2 times more important to the average consumer than increase in brightness (2000 to 3000 lumens)? True/False

Attributes	Levels	Part-Worth
Weight	1.2 kg	1.5
	1.8 kg	**-0.5**
	2.4 kg	-1.0
Brightness (lumens)	3000	1.5
	2000	**0.5**
	1000	-2.0

Product Utilities

… on average Product 2 is superior to 1

… on average consumers prefer DLP over LCD

Product 1		
Brand:	InFocus	2.5
Weight :	1.2 kg	1.5
Brightness:	2000	0.52
Resolution:	1280x800	1.89
Technology:	DLP	0.78
Price:	$1,200	-1.53
		5.66

Product 2		
Brand:	Epson	1.5
Weight :	1.2 kg	1.5
Brightness:	2000	0.52
Resolution:	1280x800	1.89
Technology:	LCD	-0.78
Price:	$600	1.53
		6.16

Simulations – First-Choice model

- Assumes consumers select product that has highest utility for them
- Utility of each product profile is the sum of the part-worths for each attribute-level in the product profile
- Utility computed for each respondent across products … and the product with the highest utility is marked as “chosen”
- Results for each respondent are aggregated and weighted to the universe, to determine product market share.

Market Simulation Methods

Product	Utility	First Choice	Share of Utility	e^U	Multinomial Logit
A	1	0.0	10.0	2.7	3.2
B	2	0.0	20.0	7.4	8.7
C	3	0.0	30.0	20.1	23.7
D	4	100.0	40.0	54.6	64.4
	10.0	100.0	100.0	84.8	100.0

- First-choice model, where the winner-takes-all is appropriate for markets where consumers tend to buy only one brand or item in the short term, as is the case for consumer durables.
- For majority of FMCG products, where consumers maintain a repertoire of brands, the multinomial logit and the share of utility methods are better suited.
- *Multinomial logit* model:

$$Share_p = \frac{e^{U_p}}{\sum_{i=1}^{n} e^{U_i}}$$

Where U_p and U_i are the estimated utility for product p and product i, and n is the number of products in the competitive set

Share of Preference vs. Share of Market

- Conjoint analysis provides estimates of *share of preference,* not share of market.
- Besides their preferences for product features, consumers' buying behaviour is dependent on brand and advertising awareness, product knowledge, product perceptions, promotions and distribution.
- Market share is not static. Dissemination of information takes time. Trends take time to reach equilibrium. There is a lag between intent to purchase and date of purchase.
- For the above reasons, conjoint study results are unlikely to accurately reflect market share. They do however provide an accurate gauge of consumers' preferences for different product features, and this information has many practical applications.

Applications

- Product design (new product development)
  - New product concepts can be simulated to provide a preliminary assessment of market **potential**
  - Product enhancements. Making trade-offs
  - Identifying niches / segments
  - Cannibalisation
- Knowledge of the relative importance of various attributes can assist in marketing and advertising decisions
- Market segments can be determined by identifying groups of consumers that have different preferences
- Price elasticities and cross-price elasticities by simulating different price levels

Advances in Conjoint Analysis

- Adaptive Conjoint Analysis
  - Adaptive conjoint analysis customizes the interview for each respondent, seeking trade-offs only on those attributes and levels, which are of relevance to the respondent.
  - The improvement in efficiency allows for the expansion in scale permitting designs with as many as 30 attributes.
- Choice-based Conjoint Analysis
  - Consumers undergo a task similar to what they actually do in the marketplace — choosing a preferred product from a group of products.
  - Because realism is of utmost importance, choice-based conjoint analysis is the preferred method for pricing research studies.

Marketing Analytics
Practitioner's Guide