Basic assumptions of conjoint analysis

* The product is a bundle of attributes

* Utility of a product is a simple function of the utilities of the attributes

* Utility predicts behavior (i.e., purchases)

Steps in conjoint analysis

A. ***Define attributes*** (brainstorm, focus groups, retailer interviews, etc.);

* should matter to consumers
* should be technologically modifiable

B. ***Select number of levels for each attribute***

* range must be broad enough
* some attributes can be represented as continuous (price, longevity)

C. ***Define hypothetical products***

* all combinations of attribute levels will generate too many products

* aim for a subset of products with **orthogonal** design, making sure that that all combinations of levels for <u>pairs</u> of attributes occur in some product

<u>Definition of orthogonal</u>:

Let "i" and"j be two levels of attribute A, and "k" a level of attribute B; then:

$$\frac{\#\text{ of products having } A_i \text{ paired with } B_k}{\#\text{ of products with } A_i} = \frac{\#\text{ of products having } A_j \text{ paired with } B_k}{\#\text{ of products with } A_j}$$

In words, the chances of finding $B_k$ in a product should be the same irregardless of the level of attribute A.

An orthogonal design for a simplified version of the air conditioner ranking problem might be,

| | | | |
|---|---|---|---|
| Unit 1 | Low noise | $500 | Strong |
| Unit 2 | Low noise | $400 | Adequate |
| Unit 3 | Low noise | $300 | Strong |
| Unit 4 | High noise | $500 | Adequate |
| Unit 5 | High noise | $400 | Strong |
| Unit 6 | High noise | $300 | Strong |
| Unit 7 | Moderate | $500 | Strong |
| Unit 8 | Moderate | $400 | Strong |
| Unit 9 | Moderate | $300 | Adequate |

D. ***Design and conduct survey***

There are several methods of eliciting preferences:

* rank order all products
* rate all products on a scale (e.g., 0-100)
* give selected pairs of products

E. ***Estimating utilities***

* Non-metric; program tries to pick utilities that minimize the number of wrong predictions for pairwise preferences

* Metric (ordinary linear regression with dummy variables); theoretically questionabale, but produces almost the same results as the fancier nonmetric techniques.

The linear regression model with conjoint preference data would be:

$$R_i = u_0 + \bullet \quad u_j^k X_{ij}^k$$

where,

$R_i$ - the ranking or rating assigned to product i

$X_{ij}^k$ - a dummy variable defined as:

$$X_{ij}^k = \begin{cases} 1 & \text{if product i has level j on attribute k} \\ 0 & \text{otherwise} \end{cases}$$

$u_j^k$ - the utility coefficient for level j on attribute k; precisely: the mean change in rank (or rating) produced when the default level for attribute k is replaced by level j

| Unit | Noise level Default=low noise | | Price Default =$500 | | Cooling Default =Strong | Ranking |
|---|---|---|---|---|---|---|
| | **X1 (High)** | **X2 (Mod)** | **X3 ($400)** | **X4 ($300)** | **X5 (Adeq.)** | **R** |
| Low noise $500, Adeq. | 0 | 0 | 0 | 0 | 1 | 3 |
| Low noise $400, Adeq. | 0 | 0 | 1 | 0 | 1 | 6 |
| Low noise $300, Strong | 0 | 0 | 0 | 1 | 0 | 9 |
| High noise $500, Adeq. | 1 | 0 | 0 | 0 | 1 | 1 |
| High noise $400, Strong | 1 | 0 | 1 | 0 | 0 | 2 |
| High noise $300, Strong | 1 | 0 | 0 | 1 | 0 | 8 |
| Moderate $500, Strong | 0 | 1 | 0 | 0 | 0 | 5 |
| Moderate $400, Strong | 0 | 1 | 1 | 0 | 0 | 7 |
| Moderate $300, Adeq. | 0 | 1 | 0 | 1 | 1 | 4 |

With this particular set of ratings, the linear regression formula will be:

$$\text{Rank} = 4.67 - 2.33\ X_1 - .67X_2 + 2.0X_3 + 4.0X_4 - 2.0X_5$$

F. ***Calculating the weight of different attributes***

* For each attribute, compute the difference between the highest utility level, and the lowest utility level.

* The weight of each attribute is its relative share of these numbers.

* This is a popular summary number of how important a particular attribute is for some person, or population

G. ***Calculating utilities for specific products***

* Encode the new product in terms of dummy variables

* Plug into the regression equation, using the coefficients that have been derived from the study

H. ***Calculating market shares***

* Given a basket of products, calculate for each person the product with highest value, and add up how many "votes" each product gets.

I. ***Calculating a demand function***

* Vary the price of the product, and watch how the market share changes

Critical issues in applying conjoint analysis

* Is the sample representative?

* Should each person have one vote, or should the respondents be weighted in some fashion (e.g., purchasing power)?

* Does the utility of one attribute depend on the level of another?

* Is the product described in a realistic, believable manner

* Will people do what they say?

* What about competitive reactions to new products, price changes?

**15 questions about conjoint analysis**

1. Which attributes?
2. How many levels on each attribute?
3. How many different products?
4. Do they have to be "plausible?"
5. How should the products & attributes be described?
6. How do I figure out an orthogonal design?
7. Do I absolutely need an orthogonal design?
8. Does each product need to be defined on all attributes?

9. Evaluate all products in one swoop, or evaluate pairs of products?

10. Should the products be ranked or rated?

11. For rating task, should the rating be a probability of purchase, or attractiveness, or what?

12. For ranking task, what if the products "in the middle" are more similar in value than products at the extremes.

13. What if the importance of one attribute depends on the level of another attribute?

14. How do we go from utility of product to probability of purchase?

15. Can I believe the market shares?