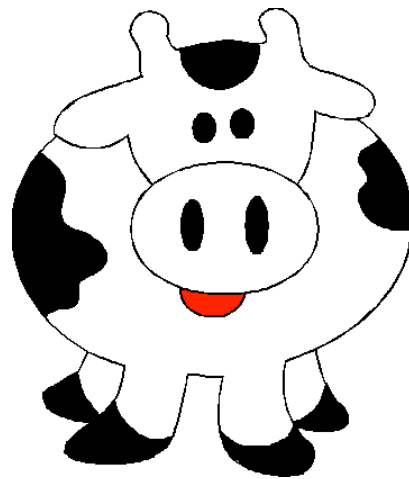


Cow's guide to



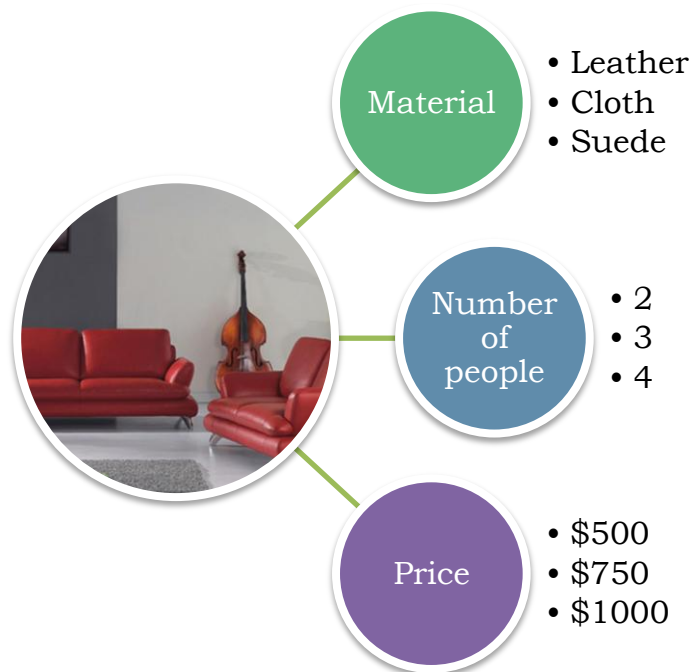
Conjoint Analysis

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What is Conjoint Analysis?

To understand what is conjoint analysis it is important to know what we can achieve through this methodology. Let's say for example you have a company that manufactures couches (sofas). You are planning to introduce new products into the market and are eager to know what will customers desire, and how much will they be willing to pay.

Suppose that couches can be assigned specific *attributes* such as material used, number of people that can be seated, and price. These attributes define a couch. Now each of these attributes can have *values* associated with them. Material used attribute can have values such as leather, cloth, or suede. Number of people that can be seated can be 2, 3, or 4. And price could range from \$500 to \$1000.



The question you have before you start manufacturing and selling your new product is – What combination of values I need to assign to the

attributes of my couch so that I can maximize my profit? This is where conjoint analysis comes in. Conjoint analysis helps to understand customer preferences and choices so that you can bring the right product to the market.

Conjoint Analysis is also extensively used in Marketing Strategy, New Product Development, Pricing Strategies, and other areas.

How to perform conjoint analysis?

To determine the right customer preference you may do a few things:

1. Ask a representative group of people and manufacture their choice.
2. Create a survey with all combinations of “attributes + values” and ask prospective customers to rank their preference. Choose the one that has the highest vote.

These methodologies are flawed for various reasons. Firstly, people will always prefer the most exquisite material at the cheapest price. So in our case most will say that they need a leather couch that seats 5 people and costs \$500. The cost of manufacture for you could possibly be \$600. Without a doubt you will sellout on your couches, but for each couch you will make a loss (of \$100). Secondly, even though our example is simplistic in the sense that our product has only 3 attributes with 3 values each, the maximum preferences a survey taker has to fill out is 27 (3x3x3). Even then he/she is destined to be bored and confused after some time. In real life, the numbers are not so small and the total combination can run into 100s, 1000s, or even more.

It therefore becomes important to find out the easier path to determine a customer's need while not losing your own wallet.

Conjoint analysis makes use of similar surveys but restricts the combination of attributes and values to a manageable level. Each such combination is called a product profile. The set is so decided so as to gain a clear understanding of customer choices and extrapolate the data to other combinations to gain a fuller understanding.

Let's do some analysis now.

There are three steps to performing a conjoint analysis:

1. Collection of data pertaining to customer preferences

Our table of attributes and values for a couch is as shown below:

Attributes →	Material	Number of People	Price
Values			
Value 1	Leather	2	\$500
Value 2	Cloth	3	\$750
Value 3	Suede	4	\$1000

First we ask the respondents what is their preference for each level. It could be asked in various ways, but the most common way is to have a scale that measures preference (Likert Scale) from “Highly Undesirable” to “Highly Desirable”. It will look something like this:

Measure →	Highly Undesirable				Highly Desirable
Value					
Leather	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cloth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Suede	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

This step is very important because it is not necessary that the relationship between value and measure is linear. Some people may highly desire two values and absolutely dislike one value.

Other ways of measuring such preferences are: Constant Sum and Top Box Scoring. You can check on the internet about their details. Each method has their pros and cons.

At the end of this step, we now know what values in each of the attributes are preferred by consumers and what are not. But we still do not know the relative preference. What I mean is, even though we know Leather is quite high is preference, but relative to Suede, how much more/less is it preferred. Though an idea can be made based on the entries, it may be difficult to ascertain where there are same selections or even difficult to quantify the relative importance. At the same time we have no idea of any background pertaining to the purchase of a couch. Independent respondents may not be planning to buy a couch and will fill the questionnaire based on ideal conditions. But say a student needs to buy a couch; his current preferences will be different as compared to his ideal preferences. This external stimulus is not easily captured in the questions already asked. Hence the relative importance within attributes is necessary to be determined. You may also refer to them as *trade-offs* and this needs to be quantified. That brings us to next set of questions in the data collection process.

A sample question can be – Everything else the same, how important is the difference between leather and cloth. The way he answers the question can be in a similar format as above.

Everything else the same, how important is the choice between leather and cloth?				
Highly Unimportant				Highly Important
○	○	○	○	○

Through these questions we can come to conclusions such as – Even though it does not matter whether my couch is leather or suede, but it

certainly matters whether it is priced \$500 or \$1000. Another conclusion may be – I don't care much about price, but the couch better be leather.

You will start to appreciate at this point how we are ascertaining an individual's preference while making a purchase decision. Now let's be more specific with him/her. Based on his highly preferred choices concerning attributes and values (there are tools available to help with these), construct a few product profiles. Note: Some surveys may want to pair up attributes (just leather and price, for instance) and then move on to full fledged profiles, thus providing further granularity. But the idea remains the same. An example of a product profile (profile A) would be – A leather couch, seats 2 people, and costs \$750. Another (profile B) could be – A suede couch, seats 4, and costs \$500.

The questions that follow should ask for a customer's preference given the two product profiles. How likely are you to prefer profile A vs. profile B? Some questionnaires prefer to ask – On a scale of 0-100, how likely are you to purchase a couch with profile A. And similarly profile B. The choice of question will depend on the tool that will be used to perform the conjoint analysis.

2. **Statistical analysis of collected data**

Now that all the data has been collected, we will need to determine the exact (as close to) preference of a customer. First, we need to arrive at a point wherein we can quantify preferences of values within each attribute in such a way that they can be added together. Right now we cannot add "highly preferred" to "moderately preferred". Neither can we assign them specific numbers, because as we said earlier – the relative importance can be different from isolated preferences, thus negating addition. To get all attributes to the same plain, *utility* for each level within an attribute needs to be determined based on the questions we asked. A respondent's

“utility” is a measurement of his or her relative strength of preference for each level of each attribute of the couch.

Such determination requires complex statistical and conjoint analysis tools and is difficult to do on paper. Detailed definition and determination of utilities is out of scope of this document and hence will be skipped.

A sample set of utilities (in parentheses) for the attributes can be as follows for a respondent:

Attributes →	Material	Number of People	Price
Values			
Value 1	Leather (0.6)	2 (1.3)	\$500 (97.3)
Value 2	Cloth (0.3)	3 (3.5)	\$750 (20.4)
Value 3	Suede (0.1)	4 (20.7)	\$1000 (1.1)

For this respondent we can say that the combination of Leather, 4 seat, and \$500 is the most preferred ($118.6 = 0.6 + 20.7 + 97.3$). Similarly we can get his second best preference and so on. One of the key assumptions in conjoint analysis is that more the preference, higher is the likelihood of purchase. This assumption is very important because it helps the company in its pricing strategy and sales forecasting.

These utility values can be used, for example, to segment populations into homogenous groups, to predict preference or acceptance among groups with homogenous utility values, and to examine the effect of alternative couch profiles.

3. Deriving conclusions

The final step is to basically take these utilities and model them into the current task at hand – could be product introduction, sales forecasting,

pricing strategy, inventory management, or others. Tools that help achieve such an end are called *Market Simulators*.

In case of product introduction we can take a survey of a sample from a specific demography (say in the area where the product is to be introduced) and then determine the likely preference of the population (market segmentations). This way you can figure out which product you need to introduce, at what price, and even the product mix, if any.

Let's say you want to come up with sales forecasting. In that case you first will have to come with expected number of buyers, the number of couches you plan to stock, and some assumption of what happens if the buyer does not get his first preference but does get his second. You can see how you can come with a good forecast. Note that the analysis tools will help you determine the certainty of achieving those targets.

Conclusion

Conjoint analysis is a powerful tool and is widely used in the marketing world. There are many flavors of conjoint analysis but the essence is the same. They may differ in the algorithms used to calculate utilities, the number of questions to ask in a survey, the survey format, and so on. But hopefully all these different methods should arrive at a common (or very close) solution. There are various tools available in the market that can be used to create surveys, help with asking questions to respondents based on previous answers, and doing the analysis.

References

1. <http://www.sawtoothsoftware.com/conjoint-analysis-software>
2. <http://www.questionpro.com/conjoint/>
3. <http://www.populus.com/techpapers/conjoint.php>
4. http://www.dobney.com/Conjoint/Conjoint_analysis.htm