

# CONJOINT ANALYSIS

Conjoint Analysis is a research technique used to measure the trade-offs people make in choosing between products and service providers. It is also used to predict their choices for future products and services. Conjoint Analysis assumes that a product can be “broken down” into its component attributes. For example, a car has attributes such as color, price, size, miles-per-gallon, and model style. Using Conjoint Analysis, the value that individuals place on any product is equivalent to the sum of the utility they derive from all the attributes making up a product. Further, it assumes that the preference for a product and the likelihood to purchase it are in proportion to the utility an individual gains from the product.

There are three phases in the analysis of conjoint data: collection of trade-off data through a questionnaire, statistical analysis of the data, and market simulation.

For purposes of this methodological description, imagine that you are researching perceptions of market research companies.

## Questionnaire

In the interactive, conjoint portion of the questionnaire, respondents are given various tasks which allow for the measurement of their perceptions of market research companies. Attributes for this project include Company Size, Location, Price, and Gestalt.

Each attribute can contain up to nine “levels” comprising different aspects of the attribute. As an example, consider the following attributes and levels:

	<i>Attribute</i>			
	<i>Company Size</i>	<i>Location</i>	<i>Price</i>	<i>Gestalt</i>
<b>Level 1</b>	Small: <\$2M/year revenues	Midtown Manhattan <i>Concrete &amp; Cabs</i>	10% more than you'd expect to pay	Businesslike, scientific, creative
<b>Level 2</b>	Medium: \$7-12M/yr revenues	Southern California <i>Traffic &amp; Smog</i>	About what you'd expect to pay	Businesslike, scientific, but not creative
<b>Level 3</b>	Large: >\$25M/yr revenues	Suburban Chicago <i>Hazy, Hot &amp; Humid</i>	10% less than you'd expect to pay	Businesslike, creative, but not scientific
<b>Level 4</b>		Rural Idaho <i>Mountains &amp; Elk</i>		Businesslike, but neither creative, nor scientific
<b>Level 5</b>				Scientific, but neither creative, nor businesslike
<b>Level 6</b>				Creative, but neither businesslike nor scientific



scientific, creative” company is “very important,” while the difference between a “small” company and a “large” company is only “somewhat important.” At this point, data have been collected that indicates which attributes are more important for the respondents and, for each of these attributes, which levels are preferable.

In the next step of the questionnaire, survey participants are presented with pairs of market research company profiles (conjoint tasks). Each description contains between two and four attributes. Respondents are asked which of the two company descriptions they would be more likely to prefer. Decision tasks such as these are repeated 20 times to provide information on each respondent’s preference for the attributes and levels.

Sample Conjoint Tasks



### Pair-wise Trade-off Tasks

If everything else about these two research companies were the same, which would you prefer?

Small: <\$2M/yr revenues 10% less than you'd expect to pay Idaho: <i>Mountains &amp; Elk</i>	○	Large: >\$25M/yr revenues 10% more than you'd expect to pay Midtown Manhattan: <i>Concrete &amp; Cabs</i>	○	○
○	○	○	○	○
Strongly Prefer Left		Indifferent		Strongly Prefer Right

Finally, participants are presented with five composite market research companies containing all four attributes and they are asked to express the likelihood they would hire such a company on a 100-point scale.

Sample Conjoint Tasks



### Calibration Task

How likely would you be to retain the services of this research company?

Small: <\$2M/yr revenues  
 10% less than you'd expect to pay  
 Businesslike, scientific, creative  
 Idaho:  
*Mountains & Elk*

Enter a number between 0 and 100. "0" means "Not At All Likely" and "100" means "Very Likely"

The conjoint/decision tasks and the final selection exercises are wholly interactive. The computer program used—ACA™, Adaptive Conjoint Analysis from Sawtooth Software—generates an optimal set of trade-off tasks for each individual. These tasks are generated by the information respondents provide on the attributes they value or find important.

## Statistical Analysis of the Data

Conjoint analysis applies a complex form of analysis of variance to a respondent's choice task data to calculate a utility for each level of each attribute. These are basically index numbers which measure how valuable or desirable a particular feature is to the respondent. The idea is each respondent's choice tasks reveal something about the relative utility that he or she has for each feature. Features which a respondent is reluctant to give up from one choice task to another are judged to be of higher utility to that respondent than features which are quickly given up.

A respondent's "utility" is a measurement of his or her relative strength of preference for each level of each attribute of the research company. The respondent's utilities are estimated using a "least squares updating" algorithm. Initial estimates of utilities are based on the respondent's rank orders of preference and his or her ratings of attribute importance. Estimates are updated following each trade-off task, and the initial estimates have decreasing influence as the interview progresses. The final estimates are true least squares, with the same weight being applied to each of the respondent's answers. For the purposes of modeling, the final estimates are scaled so that the sum of each individual's utilities predict most accurately that person's likelihood of hiring a particular company.

Utilities scaled in this way are ideal for predicting the likelihood of acceptance; they can be very misleading when reported in the aggregate or for comparing segments. For these purposes, utilities are re-scaled in such a way that the sum of the *differences* between the maximum and minimum level of each attribute equals the number of attributes times 100. This method assures that all survey respondents' utilities are equally rated in reports and analyses.

The best way to interpret utilities involves analysis of the gaps between utility levels within an attribute. This "gap" or range between utility levels within an attribute indicates that the survey participants see greater importance between certain attribute levels than between other attribute levels. As a result, these attributes with greater ranges are used to differentiate or discriminate between different market research companies.

In the current project, the attribute "Price" showed the greatest range with the resulting average importance score of 5.1, while the attribute "Location" showed the smallest range with the resulting average importance score of 1.9. This does not mean that "Price" is *more important* than "Location." This observation is better interpreted as meaning that, on average, respondents perceived that the difference between a price of "10% more than you'd expect to pay" and a price of "10% less than you'd expect to pay" was more important than, with regard to location, the difference between working with a "Midtown Manhattan—Concrete & Cabs" company or working with a "Rural Idaho—Mountains & Elk" company. The table below illustrates the utility values for these two attributes and the increased utility associated with "Price" compared with "Location."

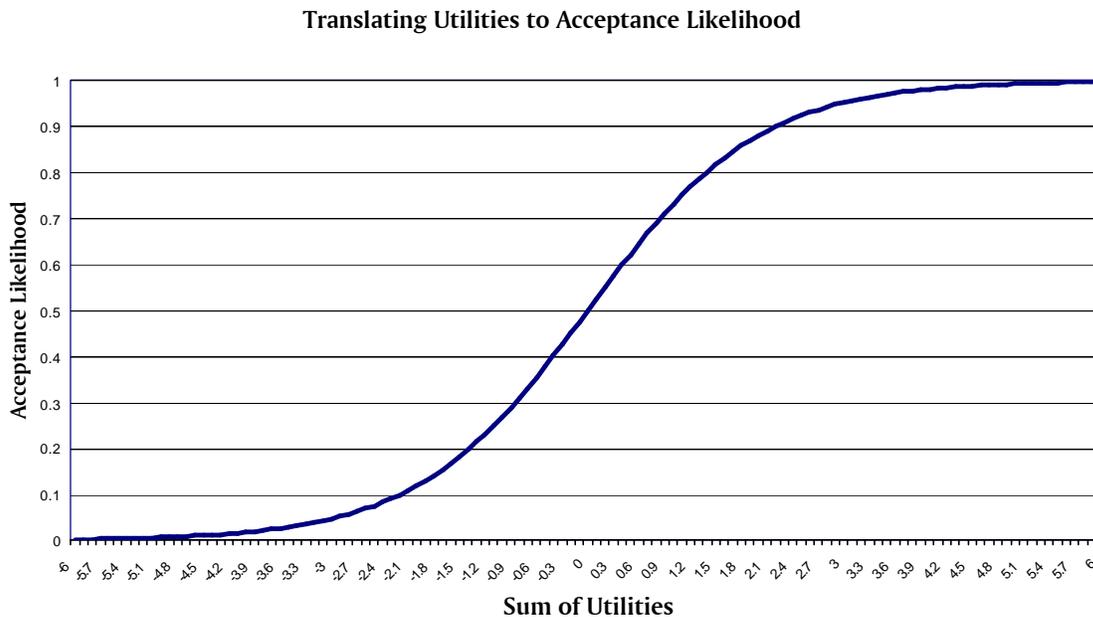
<b>Price</b>	<b>Average ACA Utility Values</b>	<b>Utility Gain</b>	<b>Location</b>	<b>Average ACA Utility Values</b>	<b>Utility Gain</b>
Level 1: 10% more than you'd expect to pay	0.1		Level 1: Midtown Manhattan <i>Concrete &amp; Cabs</i>	7.4	
Level 2: About what you'd expect to pay	77.0	Level 2 - Level 1 76.9	Level 2: Southern California <i>Traffic &amp; Smog</i>	13.7	Level 2 - Level 1 6.3
Level 3: 10% less than you'd expect to pay	151.4	Level 3 - Level 2 74.7	Level 3: Suburban Chicago <i>Hazy, hot &amp; humid</i>	23.1	Level 3 - Level 2 9.4
Total		151.6	Level 4: Rural Idaho <i>Mountains &amp; Elk</i>	41.3	Level 4 - Level 3 18.2
			Total		33.9

The absolute values of the utilities have no inherent meaning. The relative importance of each attribute, for each participant, is determined by calculating the range between the lowest level utility value and the highest level utility value within each attribute. In this instance, we can conclude that, on average, there is about four times as much utility to be derived by the difference between the “10% less than you’d expect to pay” and an “About what you’d expect to pay” (74.4) as the utility to be derived between working with a company located in Idaho and working with a company located in Chicago (18.2).

Utility values and importance scores 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 research company profiles through the use of the market simulator.

## Market Simulation

Market simulation consists of describing each market research company profile in terms of its attributes, adding up the respondent's value for all of a company's attributes and using this information to determine the relative value of each company to each respondent.



As indicated in the chart above, companies which contain those attribute levels for which respondents have higher utility values produce a higher degree of acceptance likelihood. Acceptance likelihood is calculated by adding up the sums of the attribute level utilities contained in the company profile.

Through market simulation, a “base case” is specified which contains selected attribute levels across all company attributes. Simulations can be run to determine the sensitivity of a respondent's likelihood of acceptance to modifications on each attribute.

To illustrate such an attribute sensitivity simulation, assume a base case was established which reflected a market research company with an “average” likelihood of acceptance across all respondents based upon their average preferences and utilities. A simulation could be run in which the sensitivity of the various levels of the attribute “Location” might be measured, resulting in the following breakout:

	Average Likelihood of Acceptance
Midtown Manhattan <i>Concrete &amp; Cabs</i>	20%
Southern California <i>Traffic &amp; Smog</i>	18%
Suburban Chicago <i>Humid, Hazy &amp; Hot</i>	20%
Rural Idaho <i>Mountains &amp; Elk</i>	37%

Sensitivity analyses can be conducted for all respondents, for respondents of a particular city, as well as for respondents segmented by any other demographic variable.



Conjoint Analysis has been a standard market research technique regularly employed since 1971. It is generally inappropriate for products which are evaluated by consumers on the basis of their “image”, such as beer or cigarettes, rather than on the basis of their constituent attributes. The technique has been successfully employed in hundreds of studies to predict preference for transportation services, financial services, automobiles, consumer durables, and many other industrial and consumer products and services.