Corporate R & D

Options Analysis
Version 1.5

Tutorial and Help Guide

Notes:

1. The material in this tutorial and help guide has been prepared with on-line use in mind. A consequential requirement is that each section be able to stand more-or-less alone. For sequential readers some repetition of related material is unavoidable.

2. Pages 81-103 constitute the context-sensitive help for Options Analysis when the program has been installed.

Options Analysis – Overview

Purpose of Options Analysis

Options Analysis applies when you wish to analyse choice and the sources of choice amongst options within a group of individuals as a function of differences amongst distributions of appeal or desirability. Here, appeal is treated as the generic basis for evaluative decision-making by respondents. Differences between appeal distributions across options are applied to explain differences in selection shares within populations. Option appeal ratings can be gathered in the course of any regular questionnaire survey.

Options Analysis approach breaks evaluative decision-making into two separate components:

1. assessment of the appeal or desirability of each option by each respondent, and

2. comparison of appeal levels within a selection set by an individual, leading to selection choice.

Options Analysis is wholly concerned with the relations between these two aspects of decision-making through the analysis of the appeal distributions.

While selection is the appropriate dependent variable issuing from the comparison of appeals, in turn, appeal is the appropriate dependent variable for analysis of factors that generate differences in desirability. Such analysis of appeal is amenable to generally available methods which are not included in this Options Analysis package.

The advantages of analysis of option selections via option appeal, rather than directly on decisions, are:

1. each option's appeal potential can be analysed independently of other options (when the appeal of each may have different sources),

2. Options Analysis provides a generic basis for analysis of the sources of advantage and disadvantage amongst options in relation to shares i.e. it is a methodology that applies to all decisions amongst any options, and

3. Options Analysis provides the capacity to generically simulate the consequences of variations in option appeal on decision-making.

Options Analysis concepts and methods

Options Analysis is based on the premise that choice selections are commonly dependent on the appeal levels of options within any selection set.

The analytical process distinguishes between

1. ***levels of appeal*** - attractiveness or desirability amongst options,

2. ***option advantage and disadvantage*** i.e. differences in appeal between options, and

3. ***choice or preference***.

Advantage and disadvantage measures reflect degrees of option commitment or disaffection, and indicate the changeability of each option's share in terms of distances of appeal between options.

Taking account of the distributions of option appeal ratings within a group, Options Analysis can reveal the generic character and composition of the forces contributing to each option's advantage, disadvantage and share. Such analysis can be used to show each option's strengths and weaknesses, why change in share of choice has occurred, or where and how effective action might be directed to generate change. Also included is analysis of the cross-impacts of each option on alternative options within any selection set.

Areas of application

Applications include data analysis of a current situation or simulation of possible option variants or emergent trends, plus the study of inter-option relationships, competitive dynamics, and change implications.

Types of option evaluations for analysis include those of products, services, policies, programs, practices, brands, images, candidates, parties, and institutions.

Such analysis is of importance to all those keenly interested in the evaluations, preferences, choice intentions and behaviour of client groups and customers, voters, interest groups, user groups, stakeholders, consumers, and the general public.

Professional interests involved here include those of marketers and market researchers, policy analysts, political scientists, sociologists, economists, psychologists, and corporate and public communications and advertising specialists.

Functionality of Options Analysis

Options Analysis provides concepts and software for both basic and complex analysis of option evaluation data. Managers and researchers alike can readily understand the core concepts and key assumptions. At the same time, the methods can be applied to address complicated scenarios to meet the requirements of professional analysis. Validation and testing of results are straightforward and transparent.

Methods are provided to overcome common deficiencies of polls and surveys on choice intentions. Options Analysis is capable of providing improvements in precision, reliability, interpretability and projectability of core results. Reductions in sample size are also possible.

Options Analysis does not depend on linear assumptions concerning relations between external causes and share effects. This means that Options Analysis methods can describe situations or predict outcomes where minor modifications are capable of generating major change in option shares, or, alternatively, where major option change may have little or no impact.

Flexibility and scope

Methods are flexible and usage will vary between types of application and the sophistication of the researcher.

Options Analysis mainly applies to ratings of option appeal gathered through sample surveys. Since data requirements are modest, the methods can be applied in both wide-ranging and very limited or focused surveys including those for exploration, in-depth review, monitoring or tracking.

Options Analysis - Analytical approach

Need to understand patterns of appeal within groups

For the practical development of products, services, policies, and the like, companies, organisations, governments, and others need to think in terms of the population and its categories, segments, etc. The thinking is in terms of **groups** of individuals.

To do this well we need methods of analysis that accurately reflect the group perspectives **on each option** and which, at the same time, systematically link to the underlying individual responses generating the group results. Involved here is integration of both macro and micro aspects. This would enable both "bottom up" and "top down" understanding in ways that are realistic, effective and capable of validation. With such information it becomes possible to create and modify products, services and policies adapted to personal requirements in ways which will generate the desired macro outcomes through preference change of individuals.

Common approaches for understanding influences on share

Typically, poll or preference data is collected on options or concern areas and analysed according to conventional demographic categories, usage levels, and so on. Such data often provides only the most rudimentary insights and provides little or nothing on such key factors as margins of preference and changeability.

A more sophisticated approach to considering influences on choice and share has been to focus on specific attributes of particular options and the role each plays in determining choice and share outcomes. Serious research on the relations between attributes, choice and share commonly involves major surveys and extensive use of such sophisticated statistical tools as conjoint, multinomial logit, regression and correspondence analysis.

These studies tend to be large, expensive, inflexible, and uncertain. They are necessarily incomplete because not all of the potentially relevant attributes and their interactions can be included. Thus, such approaches may be self-defeating with key elements possibly overlooked or incapable of incorporation. Their large scale means these studies tend to be one-off or infrequent exercises with shortcomings in validation testing.

The methods are primarily linear, and, consequently, have the potential to generate ephemeral results i.e. the data is only relevant to the time of collection. This happens where underlying relationships are sharply non-linear and the environment is undergoing change. Since the presence of non-linearities are expected to be common, but are usually unknown, methods are needed which provide an understanding of these possibilities. These methods, generally, do not.

Options Analysis application advantages

Options Analysis aims at an understanding of levels of advantage and disadvantage, along with choice and share, in relation to differences in appeal between options. This enables the prediction of choices at the level of each individual respondent with the possibilities for non-linear changes in shares across the group.

Similarly, change in option share, advantage and appeal focuses on modification of options (to create new options), rather than focusing on the isolated merits of attributes. In this way Options Analysis integrates the whole and the parts, including the commonly problematic interaction and non-linear effects. This holistic approach means that Options Analysis is data-light and flexible and able to be applied in all stages of research, including on-going tracking and monitoring. It also provides a more "real world" evaluation of the contributions of option characteristics.

In understanding any complex multi-agent system, systematic analysis of inter-personal heterogeneity is a central issue. Thus, Options Analysis focuses on the need to account for variability of option appeal amongst individuals. Options Analysis separately accounts for option averages, divergences, leanings, contrasts, and individual idiosyncrasies. This is done as an integral part of the analysis of choices. In other words, differences between individuals are integral to the analysis.

Basic concepts - Options and selection sets

Options

An option is an identity that is capable of evaluation and selection in its own right.

Specification of options is extremely important for making valid inferences about preferences, choice intentions and choice behaviour.

Key aspects to consider in describing an option n, say, a questionnaire, are:

1. Clarity on the identity of the option object.
2. The nature of action involved in securing the option.
3. Where and under what conditions or circumstances the option will be available for selection.
4. When the selection can or will be made and the option secured.
5. The person, group, institution or organisation for whom the option is to be applied.

The practical challenge for survey design is to encapsulate all relevant elements in a brief readily understood statement capable of respondent appraisal.

Selection sets

A selection set consists of options from which an individual can make a choice. The options may be general or specific, hypothetical or real. For the purposes of Options Analysis, selection sets are defined by the options composing them.

Selection sets vary in their character and composition

While each option must be a choosable identity, there is no requirement that options in a set be different or similar in their character, attributes, or purpose. Options within a selection set may have very different characteristics and functions, or be clear-cut alternatives perhaps with a common goal, or, further still, be variations on a theme with a variety of known or unknown purposes. A set of options may also simply be variants of an option. The options may be similar in all but name, size or price, for example.

Functions of selection sets

A selection set may be "naturalistic" in the sense that it may consist of that range of things from which people consider they would make a selection.

Alternatively, a selection set may be "given" or restricted. The set may be restricted for research, administrative, or other purposes.

Examples of administrative restriction are the range of brands in a product category in a shopper's usual supermarket, or, a list of candidates on a ballot.

Solely for research purposes, a researcher may vary selection sets to examine relations between options of special interest. Inter-option Impact Analysis can be used for this purpose. An option may be excluded then included in selection set analysis to evaluate its impact on remaining options. Alternative variants of a single option can be presented for separate assessment (e.g. including and excluding possible change), and each variant analysed within otherwise standard selection sets. Still further, option variants can be compared amongst themselves.

It is very important to have clarity on the range of possible options relevant to the objectives of any research project. Research objectives may be primarily attained through the analysis of a single well-defined selection set e.g. candidates running for an office, known referendum options, or brands of instant coffee in a supermarket chain.

Other research objectives may require the use of a wide range of variant options. During analysis these may be assembled and reassembled in a variety of selection sets for separate analysis. This type of analysis is relevant for exploring reactions to variants of new or current policies, products and services.

Basic concepts – Choice

Three meanings of choice

The meaning of "choice" here includes selection and decision-making. In the context of Options Analysis, it has three main meanings:

1. **Preference** for an option.

2. Behavioural **intention** to select an option.

3. Behavioural **action** involved in selection.

Options Analysis primarily focuses on the analysis of differences in option attractiveness and how they generate these preferences or intentions across a group. Subject to validation testing or its adoption as a working assumption intentions are regarded as precursors of action within any given selection set.

Preference

"**Preference**" applies to explicit selection from a range of propositions. The options are commonly hypothetical. Obtaining responses to these propositions may be for research purposes, public information, or to help an organisation make **its** choice. Examples include possible changes in the law, organisational policies or practices. "Public opinion" research often attempts to obtain such measures. Preferences may also be obtained for possible development options for goods and services.

A survey respondent's particular preference can be used as an appropriate criterion for assessing the **concurrent** validity of using the inferred choice output from Options Analysis appeal ratings.

Intention

"**Behavioural intention**" is an explicit prediction of personal choice behaviour. Intention refers to selecting options that individuals action themselves e.g. buying consumer goods and services, voting for politicians or parties in elections, purchasing shares in a stock market.

A survey respondent's intended option, (i.e. the most likely selection), can be used as an appropriate criterion for assessing the **concurrent** validity of using the inferred choice output of Options Analysis.

Action

"**Behavioural action**" involves activities that firmly bind individuals to an alternative for a given choice occasion e.g. agreeing to do something, buying, contracting, voting, or otherwise acting in a way that commits to an alternative.

It is also commonly assumed that a past preference will be predictive of a future preference.

These

1. intention **influences** behaviour

2. past-preference **influences** future-preference

relationship assumptions underlie much survey research.

They also underlie Options Analysis methods. Later sections of this tutorial focus on procedures for methodologically optimising these relationships and for assessing their validity.

The links between option appeal, choice intention and choice action, amongst other relationships, are outlined in PersonalChoiceModel.PPT. This is a Powerpoint file amongst the support material supplied.

Basic concepts – Sources of choice

Two immediate sources of influence on choice are:

1. blockage, and

2. appeal.

The appeal of an option depends on an individual's evaluation of it. But there are a variety of factors that may prevent evaluation e.g. unawareness of option. Such factors are referred to as "blockage".

An individual's appeal evaluation levels amongst known options within a selection set will prioritise options for choice.

Both blockage and appeal are, in turn, the result of a myriad variety of possible factors. Option appeal evaluations, for example, are commonly assumed to be influenced by perceptions of an option's attributes. By examining blockage and appeal evaluations, together with their consequences for inter-option advantage and choice, assessments can be made of current option performance and its sources. Further, it is possible to evaluate the nature of changes (e.g. the types of attribute modification or new communications) which would most effect share of option choice.

Both blockage and appeal, with their consequences for option advantage and share, are included in Options Analysis. However, for a full analysis of blockage, download the Sabre package at www.ResearchOnChoice.com. Included there are procedures for the analysis of different types of blockage and a variety of scales for decisions and decision-making.

Basic concepts − Blockage

Types of blockage

Examples of blockage that prevent an option's appeal evaluation include: non-recognition or non-recall, ignorance or unfamiliarity, unavailability, inaccessibility, or ineligibility, or, exclusion, elimination, indecision, deferral or inertia.

But automatic selection also avoids evaluation. For example, in everyday decision-making a selection can result from habits, scripts, practices, impulses or reflexes. Such approaches to selection mean that all other options are ignored i.e. blocked.

Researchers will need to consider, taking account of their research objectives, whether to obtain option appeal assessments for what would normally be an automatic decision. Obtaining appeal ratings for all evaluatable options for all cases assumes that such evaluations would be useful. Additional questioning would be needed to determine which selections for which cases would be automatic.

The most common reason for being unable to obtain an option appeal rating is that a respondent does not know the option. This includes the situation where the respondent feels insufficiently familiar to make an evaluation even where they can identify the option. When hypothetical preferences are presented, respondents are made aware of the options as part of the survey itself, so that problems with blockage are less likely to apply. But even here individuals may feel that they either do not understand or sufficiently appreciate an option, and, therefore, provide a "don't know" response. This may be seen as equivalent to unawareness.

Selection of options in the context of choice action is typically dependent on an appropriate level of awareness. For example, active consideration of supermarket goods involves pack or name recognition. In surveys, this is usually measured through **prompted** awareness. On the other hand, active consideration of services, such as insurance or banking, may commonly depend on **unprompted** awareness. This can be measured through unprompted recall elicitation of options in the relevant selection set (e.g. banks).

With sufficient supplementary inquiries, appropriately positioned before or after appeal evaluation, it is possible to determine the full role of blockage on the selection (and non-selection) of each option. The extent of such inquiry will depend on the research objectives. Options that are not detected or treated as blocked will be able to be evaluated for appeal.

The effects of blockage on share

Blockage can be a very important governor of achieved option share.

Options Analysis is able to provide an integrated analysis of the respective roles of blockage and appeal in terms of their option share contributions.

Simply calculating the proportion of times an option is blocked will give a direct measure of opportunity for an option's selection. This does not, however, measure the impact on share because blockage is not likely to be spread randomly through a group.

To assess the impacts of blockage on share it is necessary to take account of the patterns of blockage between the options over the sample respondents. For example, it is common for respondents who are unaware of one option to also be unaware of others. For these cases the impacts of blockage are shared across the unblocked options. When options **lose** share through any individual's blockage, the other options **gain** more share through effective reduction of the individual's evaluated selection set.

The effects of blockage on share can be seen from the effects of blocked options for the individual case:

1. **Blockage of all the options within a selection set:** This reduces the share of each option in the selection set by an amount equal to each option's probability of selection in the full set. The sum of these negative amounts will reduce selection of the set to zero for that case and the share accounted for by evaluation within the population below 100%.

2. **Blockage of some options within a selection set:** This also reduces the share of each blocked option by the option's probability of selection in the full set i.e. 1/N where N is the size of the set.

3. **Unblocked options in a set with blocked options:** This increases the share of each unblocked option by its proportion of the unblocked options minus its proportion of the full set of options. (If there are three options in a selection set, for an individual, and one is blocked, then the adjustment for each unblocked option is 0.5 - 0.33 = +0.17.)

Data for each of these results is summed over the respondents – treating the reductions in selection opportunity as negative and increases as positive – and percentages of the total sample are calculated. Results are provided for each of these contributions of blockage to the share of each option along with the contributions of evaluations based on appeal.

All these results are automatically produced by Options Analysis Fundamentals analysis. Here is an example of its application based on the ExampleSample.XLS to be found amongst the support materials accompanying Options Analysis. As can be readily seen, unawareness would seem to have played a minor role in the 1996 US presidential election.

Sources of blockage impacts on share				
	Clinton	Dole	Perot	Totals
Unawareness of all options	-0.1%	-0.1%	-0.1%	-0.4%
Unawareness of one or some options	-0.0%	-0.5%	-1.0%	-1.6%
Gains from unawareness of alternatives	1.0%	0.4%	0.2%	1.6%
Total impacts on shares	0.8%	-0.3%	-1.0%	-0.4%

Basic concepts – Appeal, its meaning and nature

The meaning of appeal

Appeal is a continuous or semi-continuous measure of wantedness or desirability – it is a measure of the motivational strength or attractiveness associated with each option. It might be seen to include the concept of "utility" but is broader, without consequentialist and optimality assumptions, and is action oriented. An appeal evaluation may be the product of a considered line of argument or a momentary reaction.

In the context of Options Analysis, the meaning of "an option's appeal encapsulates the totality of inputs that may precede any choice (including "beliefs" and "desires" as distinguished by some conceptual systems on decision-making).

Cognitive status of appeal

Like choice selection, appeal evaluation is a global option assessment. The assessment of appeal may be assumed to reflect a coalescence or synthesis of desires, beliefs, normative and other influencing factors. Even when these factors are present there is no need to assume that such an evaluation is consciously considered or otherwise. A respondent may or may not be able to "explain" an evaluation. And any given "explanation" may to may not be an accurate representation of sources of influence.

Research status of appeal

The absence of specification of appeal sources should not be taken to suggest that there is a lack of interest in appeal generative processes. Rather, Options Analysis can be used to identify key sources of influence for further analysis without prior assumptions about their nature or of the cognitive processes or stimuli by which appeal is generated. Furthermore, the relationship between possible sources of influence and measures of appeal is a primary means for evaluating likely effects on advantage, disadvantage and share. The absence of assumptions concerning the sources of appeal facilitates this exploratory process and recognises the possibilities for variation in these processes over individuals, occasions, and options.

Measuring appeal

The initial requirement for Options Analysis is to assess the degree of attractiveness response to the option stimulus. For this purpose, "appeal" is a measure of the elicited strength and direction of a person's motivational sentiment about an option. It is a continuous bi-polar measure ranging from extremely attractive, through indifference, to extremely unattractive. In principle, measures of appeal are unbounded.

The measurement of appeal is applied independently to each option without explicit reference to the others. However, options may be commonly introduced to a respondent in the context of a selection set e.g. "Now, thinking about the banks available in your local shopping area….", or, "Now looking at ways to improve the education of pre-school children…"

Option appeals will vary from time to time within and between individuals. Influential factors are likely to include variations in need salience, taste, circumstance, experience, accessibility, and information received. Options may be expected to elicit typical patterns dependent on timing. The current appeal of, say, breakfast cereal, will fluctuate throughout the day, ice cream appeal will vary seasonally, while the appeal of saving for retirement will have a life-cycle pattern. Since taste and experience are also important, systematic differences can also be expected between one individual and another.

Measuring by points and ranges – global appeal and appeal uncertainty

A single option appeal data-point may be seen as an individual's global view of an option. This would be the most common survey approach to the collection of such data and Options Analysis is geared to its processing.

The idea of an option's overall or mean appeal to an individual suggests a surrounding distribution of varying appeals. Each option, based on a person's relevant experience, can vary in its outcomes along with our evaluations of them. We refer to options associated with differing levels of appeal variation as "unreliable", "dependable", "unpredictable", "trustworthy", "risky", "exciting", and so on. These

descriptions refer to an option's appeal uncertainty. By contrast with global appeal, uncertainty of appeal may or may not have significance for shares of choice in a selection set. The impacts will depend largely on the size of the overlap between each individual's top-rated option appeal uncertainty distributions. Such overlaps generate variations in option selection probabilities beyond zero and unity. Options Analysis accommodates evaluations which imply selections, non-selections and ties i.e. one, zero and 1/T where T is the number of ties.

Basic concepts – Appeal, application

Inferring choice from appeal

Options Analysis focuses mainly on the decisions flowing from each individual's evaluations of appeal, between options.

Within the analysis of any particular selection set, the option that most appeals to an individual is treated as the option of preference or choice intention. Where options have equal first appeal for an individual, the choice probability is equal to one divided by the number of equal highest options. These processes define an individual's "inferred preference" or "inferred choice intention", as applicable.

Aggregation of individual inferred choice data provides estimates of share for options in the selection set. This process defines "inferred share" based on rated options (with additional adjustments on account of blockage.)

Here, for example, are results included in Options Analysis fundamentals analysis for classification of choices based on appeal and blockage for the ExampleSample.XLS included in the Options Analysis download.

Option Selection Categories			
	Clinton	Dole	Perot
Opting for (More appeal)	52.8%	27.2%	7.1%
Opting against (Less appeal)	36.2%	61.3%	83.3%
Uncertain (Appeals equal)	9.7%	9.5%	6.2%
Blockage (Unaware/Unfamiliar)	0.5%	2.0%	3.4%
Opting for (No comparative option)	0.8%	0.0%	0.0%
Totals	100.0%	100.0%	100.0%

Appeal scale metric

Options Analysis of appeal assumes that each individual's ratings approach an interval scale. This means that **within each individual's ratings**, the differences between successive units across a scale are equal i.e. a difference of, say, five units on an appeal scale, has the same meaning to the individual respondent across all parts of the scale.

Interval level measurement is required for the meaningful calculation of means, standard deviations, skewness and kurtosis used throughout Options Analysis.

Mostly, it is unnecessary to assume that unit distances have the same meaning **between respondents**. Any professionally executed sample survey is expected to deliver a representative distribution of ratings and inter-rating relationships within the limits of sampling error.

Note: Some Options Analysis procedures provide an analysis option for randomising and sorting of ratings between individuals. When an option's ratings are randomised or sorted with respect to another option, so that individuals inherit ratings of other individuals, a necessary assumption may be equality of scale units **between** individuals, particularly when these sorted ratings are the subject of further analysis. Close attention to the quality of the measurement of appeal and the removal of extraneous variation will minimise significant variations from this metric assumption.

Basic concepts - Advantage and disadvantage

Individual advantage and disadvantage

The changeability of choice depends substantially on the size of the differences in appeal between preferred options and others. Differences in appeal are referred to as "advantage" and "disadvantage" depending on whether a target option has more or less appeal than a comparative option.

The advantage of an option is any additional appeal that option has over **_all_** other options in a selection set i.e. for each individual, advantage is the difference between the option with the highest appeal in the selection set and that with the next highest.

Advantage of any option, for an individual, is either zero or a positive number. Only a sole preferred option will have **_positive_** advantage. All other options will be zero. This includes options for which an individual has **_shared_** preference i.e. one shared preference option has zero advantage over other shared preference options.

The disadvantage an option has for an individual is the appeal deficit relative to the most appealing option in a selection set. It is either zero or a negative number. The most appealing option or options will have zero disadvantage while other options will have negative disadvantage.

For individuals, advantage and disadvantage are measures of the distances to be met or exceeded to change a non-choice to a choice or vice versa.

Group advantage and disadvantage

All choice inference within Options Analysis is made at the level of the individual. However, aggregations of individual data will provide a basis for understanding the global results.

For most aggregate analysis, advantage and disadvantage are separately averaged over all the subjects in a study rating each option. These are the global measures of advantage and disadvantage.

Advantage and disadvantage can also be viewed from the perspective of the inferred choosers and non-choosers of any particular option. The average advantage of an option over a whole sample may be small (e.g. because it is only chosen by a few), but amongst the "choosers" the advantage can be very large. The distinction provides additional insights. However, the number of "choosers" and "non-choosers" vary from analysis to analysis so that care is needed in making comparisons between analyses and steps within analyses.

Average advantage and disadvantage may, respectively, be regarded as indicators of option steadfastness, disaffection, and changeability.

Advantage data - mean appeal points			
	Clinton	Dole	Perot
Advantage status for all raters			
Advantage	17.5	9.4	1.6
Disadvantage	-16.6	-24.1	-36.3
Advantage status for option selectors			
Opting for - advantage	32.8	33.8	21.9
Opting against - disadvantage	-45.2	-38.5	-42.1

Above are the advantage and disadvantage results provided by fundamentals analysis of the ExampleSample.XLS file supplied with the Options Analysis download materials. The underlying appeal

scale ranges from 0 to 100. A point to be noted is the slightly higher advantage and the lower disadvantage measures for those preferring Dole compared to the other options. This provides some contrast with his advantage and disadvantage over all raters. Such results are to be expected, especially where options have contrasting appeals.

The role of advantage and disadvantage

The measurement and analysis of advantage and disadvantage offer a key distinguishing feature of Options Analysis relative to typical analysis of surveys on share of choice.

One common assumption is that individual choice depends on the level of an option's appeal (or its sources) rather than *comparative* levels of option appeals. Such a view is implicit in the application of, say, regression analysis of predictors on choice outcomes. Such analysis will commonly generate statistically significant results. However, it will commonly also leave large proportions of the total variation unaccounted i.e. it yields a poor model. This, in turn, frequently leads to inclusion of a large number of predictors, adding marginally to the model fit, but also, often to confusion due to the added complexity.

Examination of raw survey data on known strong predictors and choice will invariably show examples of consistent choices based on simple "higher than" and "lower than" relationships between option predictors and option choice regardless of the absolute level of a predictor variable. Relevant data can be readily examined in the graphs of appeal for the 1996 US presidential candidates to be found in ExampleAnalysis.XLS amongst the support materials accompanying Options Analysis. (Based on these relationships the choice inferences were correct about 95% of the time.)

Another common but naïve assumption is that the likelihood of a change in share is related to the size of percentage differences between options. For example, a product with a choice share of 42% is more vulnerable to an option with of 38% than one with 20% share of choosers. Such thinking is fallacious. Its source is possibly an inappropriate association of the 2-option situation involving mutual trade-off in percentage points. Even in the 2-option situation the proximity of percentage shares provides no necessary indication of their changeability. Furthermore, where there are three or more options, the complexity of inter-option relationships increases enormously. (Every additional option increases the complexity many times.)

Changes in shares are dependent on changes to advantage and disadvantage at the level of the individual. Such change bears no necessary relationship to current shares. The amounts of differentiation between options will provide much clearer guide to changeability. The statistics on advantage and disadvantage measure perceptions of such differences.

As the effect of appeal on choice is mediated by advantage and disadvantage the relationships may well be non-linear. This means that the ease or resistance to changes in share may vary over the range of change. It also means that sometimes very small change in appeal (where there are small differences in advantage) can lead to very large changes in shares of choice. At other times, very large changes in appeal (where there are large differences in advantage) may lead to little or no change in choice. An examination of Options Analysis advantage and disadvantage data will indicate the possibilities for such dramatic effects. (Of course, change in shares may often occur in a quasi-linear fashion. One of the functions of Options Analysis is to reveal whether this is likely to be the case or not.)

Options Analysis further provides analysis of changes in advantage and disadvantage in terms of well-defined patterns of appeal across the sample. The scale and character of these patterns are given by each option's appeal distribution parameters. Differences between these parameters will be suggestive of the kinds of factors generating change in shares via changes in advantage and disadvantage. Key results may depend on a combination of entangled patterns requiring more complex analysis to sort out parameter contributions.

Appeal-choice relationships - Validity assessment

Assessing core assumptions

Appeal evaluations, choice intentions, and choice actions are all subject to change. Nevertheless, the core assumptions are that, within an evaluative choice occasion, any individual's choice action is preceded by the corresponding choice intention, and, in turn, by an evaluation yielding that option's appeal.

Preference is more amenable to investigation. It is the appeal and choice elicitation during the course of a survey itself that is the relevant measure for consideration (although obviously also subject to change).

It is important to note that only a very brief time may elapse between evaluation and choice - sometimes only fractions of a second and at others just several seconds. Furthermore, we are rarely in a position to measure at the moment of choice action. However, in many areas of interest, there is expected to be sufficient consistency over time to permit valid and reliable measurement and prediction with survey data.

Core assumptions on these:

Absence of Blockage **enables** Appeal *conditions* Intention *influences* Action, or,

Absence of Blockage **enables** Appeal *conditions* Preference

relationships may be accepted and data collected and analysed accordingly. Similar assumptions underlying the interpretation of polls and surveys are commonly made and widely accepted. For example, change in choice or preference outcomes may be regarded as a test of persuasion effectiveness, in the context of an advertising campaign.

However, the validity of these relationships can be tested. All that is required to test concurrent validity is a modest amount of supplementary data that can be readily gathered, along with the appeal measurements, and the data suitably assembled for assessment.

Collecting data on the key variables

A direct question on the most likely choice intention or preference amongst the options in the relevant selection set will be sufficient to perform a global test of concurrent validity of inferred choice.

Where validation is required across sub-groups of options you could collect data on choice probability for all the options in a set. Here the highest probability option within each sub-group of options, would be used to reveal each individual's criterion choice.

Measuring choice action is usually more difficult and expensive than for appeal and intention. Current or past usage or practice data may be used as an indicator. For future action, a re-survey could help, with the delay depending on the nature of the option involved. But this may not be practical. Quite apart from substantial additional cost, the time scale for action may be prolonged, variable, or both.

Given that intervening events and influences may lead to different but internally consistent changes in appeal, intention and action for each individual, concurrent choice intention or preference may remain the best single test.

A dynamic appreciation of predictive validity in changing circumstances may depend on tracking surveys.

The links between option appeal, choice intention and choice action, amongst other relationships, are outlined in PersonalChoiceModel.PPT. This is a Powerpoint file amongst the support material supplied with Tutorial download.

Evaluating the validity of Options Analysis's inferred choice or preference

To perform the validation analysis you can run a Options Analysis fundamentals analysis and use the inferred choice casewise output for the full or partial selection set. This can be related to each individual's stated choice or preference as a criterion variable for assessing concurrent validity. (This matching process is simplified by inputting the respondent intentions or preferences as "other data" in the Options Analysis initial data entry dialog.)

An example of this analysis is to be found in ExampleAnalysis.XLS amongst the support materials accompanying Options Analysis. There, using 1996 US presidential election data, inferences of individual choices amongst the three main candidates were correct 95% to 97% of the time. (This was despite some lack of correspondence between the appeal assessment criterion and that for choice intention.)

In situations with a significant proportion of tied-highest-ratings with shares of choice that are not similar to their inferred choice probabilities, it may be useful to perform an additional validation analysis excluding these tied ratings. If this filtered sample delivers a high level of predictability there is a need to explain the tie results. There may be inadequate refinement of either or both the appeal or probability scales. The bias may reflect an underlying trend in appeal change. Both these and other methodological and substantive possibilities should be considered.

The role of uncertainty

As just suggested, the relevant criterion measure to assess concurrent validity of Options Analysis inferred choice intention is the most likely choice intention. A high level of correct individual predictions (at least, say, 90%, but preferably 95% plus) will indicate that it will be satisfactory to analyse appeal, advantage, disadvantage, and choice relationships.

However, when respondents may choose their most likely option on some occasions and other options on other occasions, the calculated share proportions based on most likely choices will probably not be accurate. This is because more popular options will tend to be over-represented and the others under-represented. To obtain a more accurate result on shares of choice, you can ask: "If you were to choose one of the options right now, which would you choose?" A comparison of these results with the answers to the question: "Of these options, which would you most likely choose next time?" will indicate where and to what extent uncertainty has a role. (Both questions need not be asked of the same respondents. Indeed, given the possibility of the response to one influencing the other, it may be preferable to split the questions randomly over a sample. The test is whether the shares of the options differ beyond the expectations of sampling error.)

Of course, where probability data is collected for each option in a selection set, this can be used directly to estimate shares and compared with the inferred choice results.

Even when there are significant and substantive differences between the two estimates, Options Analysis can still be applied but with the qualification that it applies to shares of "most likely" choices.

Notes on probability scales:

1. Obtaining an estimate of the probability of choice may be usefully viewed as a method for measuring choice which reflects the weighted possibilities of different choices. As with any measure of choice it is an assessment of the selection outcome from options considered. Probability measures may be viewed as more refined and precise than discrete option choice.

However, both discrete and probability choice measures have the same diagnostic deficiencies with respect to *changing* choices and share. Specifically, neither provides a measure of the extent to which appeal must be changed to change a choice or a given probability of choice. Measures of option appeal advantage and disadvantage are required for this.

2. Free allocation of choice probabilities to options in a selection set is usually unsatisfactory. Such probabilities will not usually sum to unity. And the results cannot be satisfactorily scaled to unity - because of the unconstrained assessment. "Constraint" is a key element of the concept of choice.

One well-tested way of dealing with this is to allocate a given number of tokens, say 10, across the set, to reflect the likelihood of selection. They may be allocated to one, two or more of the options. (See Marder, p44) In the case of items for purchase or repeat use, an alternative is to ask, over say 10 occasions, how many times the respondent would purchase or use each option, as applicable.

Appeal-choice relationships - Contextual reality

Considerations in prediction of choice intention, action and preference

Obtaining high levels of validity depends on a full appreciation of the relevant methodological and substantive issues. However, some types of choice intention will be more reliably predictive than others.

Where there is significant variation between intended and actual choice behaviour (i.e. poor *predictive* validity) the intention-action link can be an important focus for additional research to understand sources of variation. Similarly, when preferences change over time, the factors underlying such change will often be of interest.

Nevertheless, a good deal is already known about the relationships between, especially, choice intentions and action and factors bearing on collection of the relevant data. Here are some questions to consider. Some are more methodological while others are more substantive in nature. Good research design and survey practice can obviate associated research problems and make analysis more tractable and compelling.

- **Do the measures for appeal, intention and action correspond to each other?** Historically, poor relationships between attitudes and behaviour have been substantially due to non-corresponding measures i.e. differences in generality, focus, action, time, context, and personal involvement. The same criteria apply to measurements for assessing appeal, intention and action. (See Ajzen and Fishbein, Chapters 2-4)

- **Is the questionnaire structure conducive to consistent responses on related measures on appeal, intention and action?** The content of questionnaires may themselves raise awareness of issues and aspects relevant to decisions amongst a set of options. Separation of questions on option appeal and intention by such content may itself lead to changes in response. (Of course the question of ordering both amongst these measures and in relation to any questionnaire content, in general, also requires consideration along with such procedures as randomisation – with or without tests of ordering effects.)

- **Is a full range of realistic options included in the tested selection set?** Where realism is a concern, it is important to research the items individuals include in their considered selection sets. In particular, it may be important to include a "none of these things" or "something else" option as a valid alternative to other options. For example, the non-voting alternative, as a preferred option, may be critical to a valid prediction of electoral outcomes. In the consideration of virtually any product or service there will be at least some who have no interest in its acquisition or use.

- **Are respondents providing socially acceptable rather than personally predictive answers?** Normative factors may be at work where options vary in their social acceptability and create response bias during data collection. This may be an important consideration in researching social problems and sensitive personal issues.

- **Is the target behaviour involuntary or automatic?** Can an option be reasonably said to be evaluated and selected *before* the target behaviour? Note, however, that Options Analysis does not require a reasoned or rational evaluation of attractiveness and does not exclude evaluations of options involving habitual or "automatic" choice. However, the fact that a selection is not evaluated may mean that it is more appropriately treated as blocked.

- **Is the choice under the control of the respondent?** In practice, a choice may be made by someone else in a household or organisation. For example, a child's breakfast cereal may be chosen by the household shopper. A mortgage source may be more determined by institutional policy than the preferences of the loan seeker. Equipment acquisition may be in the hands of a purchasing department rather than those using the equipment, or vice versa. Supplementary questions may be needed to determine whether any particular respondent is a member of the target group for the selection set.

- **Is there access to or availability of selected options?** Unexpected or unconsidered environmental conditions can block or differentially facilitate intended choices e.g. supermarket out of stock; may not

meet eligibility requirements to obtain a public service. Also, someone wanting to access an option may not have the resources or skills to do so or may feel the avenue is precluded. These situations are more appropriately treated as blocked.

- **Are there significant timing differences in appeal salience between options in a selection set?** Such salience differences can introduce choice changes solely dependent on measurement timing. Just what timing is involved depends on the nature of the options in the selection set. For daily options the time differences may be very small but still critical. For lifetime options, differences of months or even years may be significant. (For effects of the hyperbolic discount curves involved here on attractiveness and choice and choice changing, see Ainslie pp 63-67 and on.)

- **Did the need for action arise?** While any option may be seen as the most attractive in a selection set and identified as the option of choice intention, the need to select it may not arise or apply during any specific period. (Also to be included here is the inversion of the "do nothing" option. In this case, the need to apply one of the options arises when no need was foreseen and the respondent had stated that there was no intention to make the choice.)

- **What is the time span between declared intention and behaviour?** As time passes there will be changes in conditions which influence intentions and subsequent behaviour. The best possible predictions will be obtained when intentions are measured just prior to behaviour. Decreasing predictive validity can be expected with increased time between a stated intention and choice action. The time scale involved can be influenced, amongst other factors, by the nature of the selection set and the recency and frequency of associated behaviour.

- **What is the intensity of persuasive activity between declared appeal, intention and action?** If there is an advertising or political campaign, for example, a lower relation than otherwise is to be expected.

The question of time

Time and timing are obviously important to obtaining valid data and understanding changes in appeal, advantage, disadvantage, and share between options. This raises the significance of tracking and monitoring surveys for reviewing the change dynamics of these factors within target groups for selection sets of options.

Tracking and monitoring surveys are usually limited in scope and size for reasons of cost. However, the modest data requirements of Options Analysis makes possible the study of tactics and strategy and trends across a selection set in ways that are not otherwise possible.

This type of on-going research places the issues of prediction in a more dynamic context. The concern is less with a definitive outcome and more with an appreciation of the emergent properties of option appeal, intentions and action relationships as the relevant environment and the needs of individuals undergo change.

Measuring appeal – Ensuring high validity

Developing a valid measure of appeal

Satisfactory measurement of option appeal is essential for the effective use of Options Analysis. Correct inference of option choice or preference from a set of option appeals depends on it.

Maximally valid results will depend on the options on which appeal is measured being identical to the options for collecting choice or preference data. Take, for example, research concerned with vote intentions for a list of candidates. The required appeal measurement is **not** "**the appeal of each candidate**" but "**the appeal of <u>voting for</u> each candidate**". Both conceptually and substantively the need for a common option identity can be critical to high validity.

Testing option identity across appeal and choice or preference measurement involves application of the "principles of correspondence". (See East pp 75-79 for a summary of work of Ajzen and Fishbein.) Five areas in which to consider correspondence of option identity are:

1. The **target, focus or object** of action e.g. candidates, brands.

2. Any relevant **action** e.g. voting, buying, using, hiring.

3. The **context** e.g. national election, supermarket used by respondent.

4. The **time** e.g. next month, tomorrow, right now, within two years, next visit.

5. The **personal aspect** e.g. for me, for my son, for my firm, for my community, for my country.

Close examination of proposed appeal and choice questions, in the context of the research objectives, will indicate whether these issues have been dealt with in ways likely to deliver valid results.

Variation in option identity

Variations in the identity of an option between measured appeal, choice or preference can be expected to compromise validity and create inferential errors. The two main sources of error are:

1. Variations in the measurements associated with variations in option identity.

2. Variations in selection sets applied between appeal and choice or preference.

Ensuring that the option rated for appeal is identical with the option considered for selection is important because it is the validity of the appeal-choice relationship that allows meaningful analysis of the impact of appeal on choice.

Measurement variation and option identity

Clearly, differences, between measured option appeal, and, the appeal associated with a supposedly identical but **actually** different choice or preference option, can lead to different choices or preferences. The incidence of the consequent changes will depend partly on the perceived significance of differences in option identification.

A political example would be the rating of **general appeal of individuals** rather than the **appeal of voting for specific candidates**. Take the 2000 US presidential election and a political survey concerned with the candidature of Gore, Bush, and Nader. In an appeal assessment of each individual generally, it seems likely that both Gore and Bush would be rated principally as politicians with presidential aspirations while Nader, with similar aspirations, would also be rated for his standing as a consumer affairs warrior - which may not always be seen as relevant to his presidential candidacy. The vagueness and potential confusion in such a general appeal rating will have a validity reducing effect in relation to expected candidate vote intentions.

On the other hand, if the "voting" component were applied in **both** appeal and intention evaluations a more valid result is to be expected. For example, the "voting appeal" of a meritorious but unlikely-to-win candidate can be expected to be discounted due to the perceived likely wastefulness of such a vote.

Selection set variation and option identity

Perceived relevance of options to selection sets can also vary between appeal assessment and option selection. For example:

• A product with highest **general** appeal to shoppers may be poorly predictive of buying intentions if it is not available where the shopper shops. (There is a need to make sure availability is a consideration, or, is ignored, in **both** measuring appeal and option selection.)

• A service with highest **general** appeal may be a poor predictor of service use intentions if it is not clear that personal eligibility constraints apply to **both** appeal assessment and intended use.

• A candidate with the highest **general** appeal based on personal attractiveness *per se* amongst those running for a public office may not even be considered for vote intention if the candidate is seen to have little chance of winning. (Both assessments should be made on the basis of **voting** for a candidate.)

Measuring appeal - Obtaining a discriminating scale

Desirability of refined scales

Measurements of appeal can be regarded as refined when individuals are able to identify scale points reflecting the real differences they perceive to exist between options. This would involve at least as many scale points as all measured individuals are prepared to assign to the options in question, and, such additional scale points as are needed to satisfy interval metric properties reflecting individual perceptions of appeal distances between options.

An appeal scale will fall short of its predictive potential insofar as its scale metric stops respondents making distinctions they would see as sufficient to decide a choice. This will occur, for example, where ratings of options are equated when their appeal is actually viewed as different. Such fudging effects will impact most on estimates of option share. Fudging errors will be greatest amongst options seen as sufficiently similar to be equated on a crude rating scale but where, in fact, one option is generally seen as having more appeal than the other. Since fudging effects of unrefined scales are likely to be unknown (as they are indistinguishable from truly equal ratings), it is preferable to use refined scales whenever there is any interest in inferring individual choice or choice shares (which is usually the case).

It is critical to recognise that the scale refinement required in this context is quite different from the common survey requirement to establish a population or sub-group's mean rating and dispersion. Commonly, comparisons are between group means. By contrast, Options Analysis makes key comparisons amongst each individual's ratings. These are used to calculate advantage and infer choice option by option for each individual. Measures of agreement (e.g. Likert scales) are not appropriate for measuring appeal.

Thermometer scale

A thermometer scale with 0 to 100 "degree points" seems to work quite well in practice. In the US National Election Study a thermometer scale has been in use for more than 20 years. In the 1996 Study, wording along the following lines was widely applied:

> "I'd like to get your feelings toward some of our political leaders and other people who are in the news these days. I'll read the name of a person and I'd like you to rate that person using something we call the feeling thermometer. Ratings between 50 degrees and 100 degrees means that you feel favourable and warm toward the person; ratings between 0 and 50 degrees mean that your don't feel favourably toward the person and that you don't care too much for that person. You would rate the person at the 50 degree mark if you don't feel particularly warm or cold toward the person. If we come to a person whose name you don't recognise, you don't need to rate that person. Just tell me and we will move on to the next one."

The "thermometer" concept is one to which respondents can readily relate. For each rating question about 30 scale points out of the 100 tend to be assigned ratings. The points are not evenly placed along the scale so it cannot be readily reduced to a scale of fewer points. A 20-point scale would preserve most of the rating information but no shorter.

To ensure valid measurement of appeal for Options Analysis purposes the format of the question would need to be adjusted so it corresponded closely to the relevant choice action or preference. For example, if voting were the criterion, the words "the person" and "that person" may be suitably replaced by "voting for the/that person". The introductory sentence would also need to be changed to a voting focus.

While the question may seem lengthy, it would usually only be stated once and applied to a set or even multiple sets of options.

Eleven-point rating scale

The Australian Election Study 1996 and the New Zealand Election Survey 1996 carried questions along the following lines:

> "We would like to know what you think about each of these political parties. Please rate each party on a scale from 0 to 10, where 0 means you strongly *dislike* that party and 10 means that

you strongly *like* that party. If you haven't heard about that party or don't know enough about it, please circle '99' under 'don't know'"

The Australian data tends to show a good spread of ratings but relatively more banking-up towards the ends than the US results. The reasons may be substantive, methodological, or both. But one would suspect that "shorter" scales would be more susceptible to banking-up than "longer" scales.

Again, to ensure correspondence with a criterion choice, such as voting, for application with Options Analysis, "like" and "dislike" would need to be suitably qualified.

Unbounded write-in scale

In principle, appeal scales are unbounded in the sense that it is always possible for an object to be more extremely attractive or unattractive than any currently known or rated object. A scale which avoids the constraints of maximum and minimum values is Eric Marder's "unbounded write-in scale". Its only point of common reference is the point of indifference. This type of scale can avoid any build-up of ratings at the extremes. Unbounded write-in scale questions can be worded as follows:

> "This section lists some brands. Please tell us how you feel about these brands by writing L's, D's or an N into the boxes next to them.
>
> • If you like a brand, write L or LL or LLL or as many L's as you want (the more you like it, the more L's you should write next to it).
>
> • If you dislike a brand, write D or DD or DDD or as many D's as you want (the more you dislike it, the more D's you should write next to it).
>
> • Please don't leave any box blank. If you are neutral or don't care about a brand, that is if you neither like nor dislike it, write N." (Marder, p 156)

Marder (pp 159-60) has demonstrated that this method applied to political leaders yields unimodal distributions with long tails compared to the banked up tails for constrained scales covering the same politicians. The principles underlying the method also seem to accord with Neuringer's variation of Herrstein's matching law. (See Ainslie, p 65) These results appear to confirm the artificiality of the banking-up and consequent metric distortions in the tails of constrained scales. The unbounded write-in scale is eminently suitable for mail surveys and self-completion forms, and may be adaptable to telephone interviews. These findings also suggest the need for with write-in boxes for "off-scale" negative and positive ratings when conventional ratings scales are used.

Note on example questions: Analysis of questions in the non-specific forms quoted above may work satisfactorily for their intended purpose. Relevant actions and other contextual elements may be assumed by respondents to be obvious from the nature of a survey. However, this is not always the case and implicit factors should be made explicit, leaving little to chance. Furthermore, where the relationship between choice or preference and appeal is important, a tight correspondence is required to achieve the highest levels of validity. This means that the option for which appeal is rated and option elicited for choice or preference should be the same, including the identity of the object, the nature of any action involved, and the context. This point *cannot* be overemphasised.

Notes on the practice of data collection: The above format of the thermometer scale question incorporates unawareness as a possible response. More commonly, a respondent's awareness or familiarity with an option is determined first. Then, only the options on which there is the requisite degree of awareness/familiarity are ratings collected. This is likely to be the more convenient approach, especially if the options are many or it is important to establish a specific level or levels of awareness or familiarity. Both awareness/familiarity (as kinds of blockage) and appeal data are input to Options Analysis and their separate impacts on share of choice are analysed.

Sound practice in the presentation of options for rating also requires careful consideration of possible ordering effects. While randomisation is routinely used with computer controlled telephone interviewing, it is highly desirable in all questionnaire formats. Randomisation may be supplemented with the collection of question order data to allow the exploration of order effects between specific options and adjustment of ratings where appropriate.

Measuring appeal – Removing extraneous factors

Sources of variation in raw appeal data

The relationship between appeal and choice depends on attractiveness between options for an individual. Each respondent's appeal ratings and inferred choice are independent of others within a sample. However, the full sample data for appeal ratings includes variation both within and between the cases. Confounding between-case variation can be removed.

Two important components of between-case variation are:

1. **Differences between individuals' attraction to the _set_ of options.** Selection sets will vary in their generic appeal amongst individuals. For example, sets consisting of fast food outlets, sound systems, and political parties will each vary in their general attractiveness to different individuals.

2. **Differences between individual rating styles** ("leniency error") where each individual applies a different degree of "hardness" or "softness" to a set of options.

Both generic motivational levels and leniency errors apply to each individual's _set_ of ratings. They create differences between individuals in terms of their rating average. After removal of this usually irrelevant variation between individuals, differences between each individual's option evaluations will remain.

Adjusting appeal to remove extraneous factors

Removal of extraneous between-case variation is important for sound interpretation of primary data and analysis of component influences on choice. It also has important technical advantages.

At the same time it is essential that any adjustment not affect the underlying interval metric properties of the appeal scale.

Options Analysis provides the necessary procedure to remove the confounding variance. The adjustment is achieved by standardising the options' mean for each case on the grand mean and adjusting the appeal ratings for the case by the same amount.

Effects of adjusting appeal

Although each _set_ of respondent ratings share the same mean, the distances amongst each individual's ratings remain unchanged. Because the distances remain unchanged, both individual and global share, advantage and disadvantage are unaffected.

Each option's mean appeal across the sample is also unchanged. At the same time standard deviations, skewness, kurtosis and correlations are changed with the new distributions. These changes may be substantial and can have significant impact on the analysis of sources of share and advantage.

For a selection set of two heterogeneous options, parameters will usually simplify to differences between means, skewness and inter-alignment contrasts. This is because the pairs of casewise ratings pivot around the grand mean. Standard deviations and kurtosis will be almost the same for each option. Where there is non-zero skewness it will be almost the same for each option but with opposite signs. An unadjusted correlation of +1 will reduce to 0. For all other correlations the adjusted result is always -1. This complementary of the adjusted appeal ratings for two options will be most readily understood if the distributions for "doing something" and "not doing something" are considered as a selection set.

With sets with an increasing number of options, all parameters will increasingly vary amongst themselves across the options. Nevertheless, positive associations between unadjusted options and case means will still be assimilated in reduced standard deviations (to varying degrees) while other associations will show in negatively adjusted correlations.

The effects of casewise adjustment between two options are illustrated in the following graph.

ADJUSTMENT OF RATINGS FOR FOUR CASES ON TWO OPTIONS
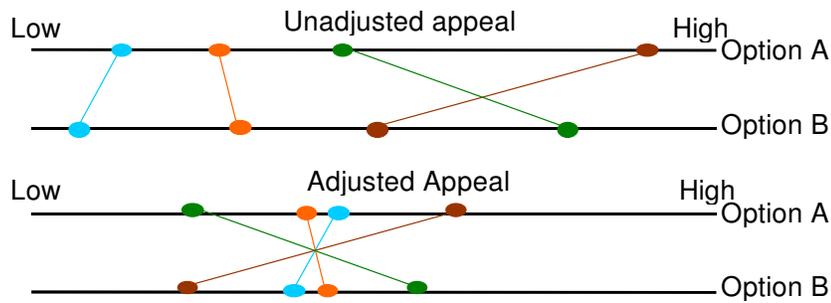
Technical advantages of adjusted appeal

A limited number of rating scale measurement points can hamper both analysis and interpretation. An important side-benefit of casewise adjustment is that it creates many additional measurement points between the original ratings. This has important technical advantages:

1. Options Analysis involves the standardisation or change of skewness and kurtosis to specific targets. This requires a flexibility that may not be available with only a limited number of data points. Casewise adjustment means that such transformations are more likely to be achieved.

2. Casewise adjustment provides data "texture" or gradation which may be assumed to characterise the reality of the underlying distribution. This reduces the likelihood of "lumpy" or "flip-flop" share or advantage results emanating from parameter adjustment or simulation analyses. Such major shifts in results can artificially emerge from the use of coarse scales.

Some Options Analysis procedures for changing inter-option correlations involve swapping ratings between cases through sorting or randomising. Doing this implies an equality of scale metric **between** cases. Such an assumption is more likely to be reasonable where sources of differentially extraneous influence are removed. Casewise adjustment helps achieve this objective.

When to perform casewise adjustment to obtain adjusted appeal

Casewise data adjustment to unadjusted input data is usually a good idea. Select "Casewise Adjustment" in the very first Options Analysis dialog after you start the program, especially if you are considering anything beyond a Fundamental Analysis.

For some types of simulation, casewise *re*-adjustment of changed data may be considered (although it is not usually recommended). A checkbox on the relevant simulation dialogs provides for this. **Not** readjusting casewise data for a new scenario makes evaluation of change impacts more straightforward. It involves a direct before-and-after parameter-by-parameter comparison of share, advantage, and disadvantage outcomes. Readjustment allows for a new parameter structure reflecting the new scenario but makes it difficult to relate the new to the prior parameter results. The un-re-adjusted analysis may usually be interpreted as the "current view" of the selection set while the results for a re-adjusted analysis may be interpreted as the "emergent" or "future view".

When to un-adjust adjusted appeal

After creating a new option scenario you may wish to see how a changed option performs in a new selection set. Options Analysis provides the data within its output for you to "un-adjust" the scenario for input with the new options and consequent re-adjustment in the new context. (In practice, it will often be simpler to include the unadjusted option in a new selection and to re-adjust it in the new context.)

Note: Some users may wish to consider applying regression analysis as a method to achieve the above objectives. This is not recommended. Regression analysis adjustment would be applied optionwise by contrast with the casewise method above. While the results may frequently be similar, they can sometimes be simply incorrect. On other occasions they may be biased according to the mix of options analysed. It also undermines the metric assumptions of the appeal data. For example, it changes the size of differences between an individual's ratings of options and unties tied ratings.

Options Analysis methods

Introduction

Options Analysis procedures incorporate a range of methods aimed at providing insights into blockage, appeal, advantage, disadvantage and share – their presence, levels, structure and interrelationships.

An important feature of most procedures is the ability to supplement summary results with the output of listings of casewise results. This enables the output of one procedure run to become input to another. In this way the methods provided by Options Analysis are capable of great flexibility.

By no means all possible options analysis procedures are included in the current version of the program. Most notably, programs for full factorial and hierarchical entanglement analysis are not included. Nevertheless, such analysis is possible through iterative application of current methods. These extended procedures are described In this tutorial.

Core analytical methods

The basic orientation for analysis is one of varying levels of depth and detail. At one end is the statistical description of each option appeal distribution and at the other is parameter entanglement analysis. The level of "drill-down" required will depend on the significance of the research, the nature of the data, and the experience, interests, time and resources of the researcher.

The starting point of most analysis will be a basic description of blockage, appeal, advantage, disadvantage and share. Fundamentals analysis is designed to produce this for both casewise unadjusted and adjusted data.

The other procedures mainly take advantage of four analytical techniques:

- Filtering

- Standardising

- Randomising and ordering

- Simulation

Filtering

Options Analysis offers considerable flexibility in filtering either or both options or cases.

Filtering is built-in to the procedure for option cross-impact analysis. Here the filtered comparisons are between selection sets with an option included and excluded.

More generally, there are the built-in filtering procedures of Excel which can be used to define both option selection sets and the sub-sample to which the analysis is to be applied.

Options Analysis always assumes that the *visible* set of data (which is the result of any Excel filtering) makes up the sample for any current analysis.

Standardising

Standardising the appeal distribution parameters plays an important part in understanding the general nature of the factors underlying advantage, disadvantage and share.

Conceptually, parameter standardisation is equivalent to the use of the "grand mean" in ANOVA. Here the standardised or "averaged" parameters with consequent effects on advantage, disadvantage and share provide standards for comparison of parameter differences amongst options.

These standards also provide a means of statistical control so that further standardisation for other factors can be evaluated in a step-by-step manner.

Randomising and ordering

Like standardising, randomising is also applied as a method for statistical control and to provide a uniform standard for comparison. Randomising involves a mixing of an option's ratings over the cases so as to reduce the between-option correlations to as near-zero as possible i.e. to eliminate systematic associations.

Other kinds of "re-ordering" are provided mainly for use in simulations. For example, one procedure involves sorting all the options from highest to lowest appeal i.e. in concordant order.

Simulation

Simulation provides opportunities for evaluating the inferred effects of *selective* changes to the appeal of one or more options in terms of the consequences for advantage, disadvantage and share.

Of course, simulation is not only useful as a projective procedure. It is a particularly important means for developing and testing a full understanding of option change dynamics.

Statistical tests

Most procedures are supported with a range of statistical tests for differences, changes and associations.

The statistical tests are generally non-parametric. This reflects the need to apply methods without linear assumptions in an environment which is inherently non-linear.

Note: While output of case data listings for analytical results is readily available (with little or no processing overhead), the output can result in large files. However, given the sometimes substantial processing involved in some Options Analysis procedures it is preferable to request casewise listings if they might be used. The sheets listing the surplus data can always be deleted later.

Fundamentals of appeal data

Basic data is produced by Options Analysis using the fundamentals analysis procedure.

Included in the output for the identified selection set of options are:

1. A description of the input in terms missing data, blockage, cases having option appeal rating data, and so on.

2. Inferred share results based on appeal and blockage data.

3. Option appeal advantage and disadvantage data for the whole sample and for those inferred selecting each option.

4. Data on each option appeal distribution for mean, standard deviation, skewness, kurtosis, maximum, minimum, range and variance.

5. Product-moment correlations between appeal distributions.

6. There are test results for the presence of differences between appeal distributions.

If casewise adjustment of input appeal data is requested, (as it usually would be for unadjusted input data), then results are provided for **both** unadjusted and adjusted data. While the unadjusted statistics are of general interest, the casewise adjusted data is of greatest significance for the analysis of advantage, disadvantage and share.

The casewise adjusted appeal distributions are important for the Options Analysis methods involved in the partitioning of sources of advantage, disadvantage and share. This is because the casewise adjustment process eliminates key confounding factors contained in the unadjusted data. Differences between options amongst the appeal distribution parameters are important for creating differences in option advantage, disadvantage and share.

A full example of the output is to be found on the fundamentals analysis sheet in ExampleAnalysis.XLS included in the program download. Here are the results for inferred share and adjusted appeal parameters for the ExampleSample.XLS also included in the download. (The residual 0.4% share is accounted for by cases unaware of all options.)

Inferred Choice Option Shares				
	Clinton	Dole	Perot	Totals
Inferred choice shares				
Option shares	58.1%	31.7%	9.9%	99.6%
Split preferences as % of total	4.5%	4.4%	2.8%	11.7%
Base model				
Base Model shares	33.3%	33.3%	33.3%	100.0%
Deviation from Base Model	24.7%	-1.7%	-23.5%	-0.4%

The table for the unadjusted and adjusted parameters shows a number of points. First, it will be noted that appeal scales provide data with small standard errors compared with percentage data. Continuous data is more precise. Second, adjustment will always maintain the values of the option means while commonly reducing the values of the standard deviations, skewness and kurtosis, and increasing the negativity of correlations). Thirdly, option variances will be reduced by the removal generic motivational levels and leniency errors. Fourthly, the maximum, minimum and range increase when case means are

adjusted to the grand mean while maintaining individual differences between option ratings. While casewise ratings will lose their absolute meanings, the relevant information relating to advantage, disadvantage and option choice is unchanged. (Note that the 0-100 input scale has arbitrary limits and the underlying scale is unconstrained i.e. the ranging of the adjusted scale outside the original limits does not matter.) Fifthly, the removal of extraneous variation can be expected to lead to some reduction in the size of standard errors.

APPEAL DATA	Unadjusted			Adjusted		
(Statistics and standard errors)	Clinton	Dole	Perot	Clinton	Dole	Perot
Means	59.3	51.8	39.6	59.2	51.8	39.7
se	0.7	0.6	0.6	0.6	0.6	0.4
Standard deviations	29.6	23.5	23.8	25.4	22.9	17.6
se	0.5	0.4	0.4	0.4	0.4	0.3
Skewness	-0.6	-0.3	-0.2	-0.3	0.4	0.1
se	0.1	0.1	0.1	0.1	0.1	0.1
Kurtosis	-0.6	-0.3	-0.6	-0.4	-0.1	0.0
se	0.1	0.1	0.1	0.1	0.1	0.1
Maximum	100.0	100.0	100.0	117.0	117.0	97.0
Minimum	0.0	0.0	0.0	-16.3	-6.3	-11.3
Range	100.0	100.0	100.0	133.3	123.3	108.3
Variance	874.8	551.6	567.2	643.5	523.4	309.9

Product-moment correlations for adjusted data are likely to be generally useful for providing indications on the level and direction of association and how they are affected by the casewise adjustment process. Correlations for adjusted data are at least partly determined by the nature of the adjustment process itself. The influence of the adjustment process is greatest for small selection sets. For example, for selection sets of only two options the correlation will nearly always be −1.0. Even correlations for selection sets of, say 10 options, should be regarded as only indicative of underlying relationships.

CORRELATIONS	Unadjusted			Adjusted		
	Clinton	Dole	Perot	Clinton	Dole	Perot
Clinton		- 0.44	+ 0.02		- 0.74	- 0.49
Dole	- 0.44		+ 0.10	- 0.74		- 0.22
Perot	+ 0.02	+ 0.10		- 0.49	- 0.22	

Note: The term "parameter" is used throughout to refer to key distributional descriptors (rather than necessarily in its strict statistical).

Option Impacts Analysis

Option Impacts Analysis is somewhat different from the other methods provided by this Options Analysis package. It shows the relative frequency with which each option draws its preferences from each of the other options. It allows an assessment of the competitive structure amongst the alternatives in terms of comparative preferences.

The impact of one option on others is determined by comparing global shares of the alternatives with their shares when a target option is removed. This reveals the extent to which the target option's share is drawn from each of the others, providing an instantaneous measure of preference sources and flows and impacts on advantage and disadvantage.

When there are only two options within a selection set, their impact on each other is obvious and direct. If one option is eliminated then the other has 100% monopoly of choice.

When there are three or more options in a selection set, the individual relationships between the options, in terms of their mutual impacts, are more complicated and worthy of further analysis.

The Option Impacts Analysis procedure only applies to three or more options.

Firstly, share, advantage and disadvantage data is obtained for all options in the full selection set. Then a re-analysis is performed with a single option removed. Comparison between the two sets of results will reveal the impacts of the target option (the option removed from the analysis) on the share, advantage and disadvantage of the remaining options.

Such analysis is repeated for each of the options in the selection set revealing the impacts of each on the remaining options.

The information from this option impacts analysis includes:

1. Reductions to other option shares attributable to the inclusion of each target option.

2. Share sources amongst other options that compose the target option's share.

3. Absolute and relative reduction in each option's advantage attributable to inclusion of the target option.

4. Absolute and relative increase in each option's disadvantage attributable to inclusion of the target option.

A full example of option impacts analysis, including share, advantage and disadvantage, is to be found in ExampleAnalysis.XLS amongst the support materials accompanying the Options Analysis download. The table below shows the results just for share.

Impacts of options on shares			
	Clinton	Dole	Perot	Totals
Gross shares	58%	32%	10%	100%
Shares for reduced selection sets				
Clinton excluded		66%	33%	99%
Dole excluded	72%		27%	100%
Perot excluded	63%	37%		100%
Impact of option in share points				
Clinton's impacts		-35%	-23%	-57%
Dole's impacts	-14%		-18%	-32%
Perot's impacts	-5%	-5%		-10%
Sources of option share				
Clinton's sources		60%	40%	100%
Dole's sources	45%		55%	100%
Perot's sources	51%	49%		100%

Partitioning appeal, advantage and share – Sources of group effects

Relations between appeal and share, advantage, and disadvantage are complex

We can readily understand how the character of options and consequent appeals influence *individual* choice - the most attractive option is likely to be the option of choice intention or preference. What is not so clear is how general variation in the appeal of options amongst individuals systematically influences share and advantage levels *between options within population groups*.

Share of choice and its sustainability are commonly related to patterns of advantage and disadvantage in complex ways. Share can be very large and very fragile (i.e. a small advantage amongst many people), or very small but very strong (i.e. a large advantage amongst a few people), or any other combination.

Similarly, patterns of advantage and disadvantage reflect complex patterns of differences between the appeals of options in a selection set. While changing some aspects of an option may increase or decrease appeal "across the board", other changes increase appeal amongst some while reducing it amongst others, and each to varying degrees.

Options Analysis provides methods for unravelling such complexity.

Generic forces influencing option appeal

An option's *raw* appeal distribution for a group reflects the sum total of forces bearing on an option's *absolute* attractiveness across a group and to each individual within it.

Similarly, an option's *casewise adjusted* appeal distribution reflects the sum total of forces bearing on an option's *relative* attractiveness within a selection set across a group and to each of the individuals in it.

Each option's appeal distribution may be viewed as the result of generic component effects reflecting the direction, scale and character of option specific forces on the distribution.

Differences amongst options can be expected to generate different appeal distributions with consequent differences in advantage, disadvantage and share.

The following set of Options Analysis applications involves revealing the composition of each option's generic influences on advantage, disadvantage and share. Analysis of these generic influences provide:

- strategic insights on sources of strength and weakness,

- identification of points of threat or opportunity,

- indications of the general character of the factors linked to them, and

- the types of change most likely to affect choice outcomes.

…

The nature of forces are characterised by the option appeal distribution parameters included in the following table.

Generic measure	Distributional effects
1. Mean	Determines the general level of option appeal to a group.
2. Standard deviation	Determines the extent of variation in appeal of an option – the appeal disparity across a group.
3. Skewness	Determines the extent to which more group members lean towards the top or bottom of the range of an option's appeal.
4. Kurtosis	Determines the extent and manner in which group members have spread their evaluations across the range of appeal or concentrated them about the mean.
5. Correlation	Determines the extent to which group members' appeal evaluations are in concordant, contrasting, or another form of systematic inter-alignment between options.
6. Idiosyncratic variation	Determines the extent to which appeal evaluations vary uniquely amongst individuals (i.e. randomly from a groupwise view).

Whether survey respondents are blocked from an evaluation, i.e. aware of an option or are at least sufficiently familiar to provide an appeal rating, is a further factor determining the presence of appeal, and, consequently choice. This information is also included in relevant analyses.

Individual appeal uncertainty about their appeal rating can also be added to this list.

Advantages of generic analysis

The use of generic influences of appeal has obvious advantages over the typical use of a myriad of project specific influences varying from project to project. Analysis is reduced universally to the above appeal factors and three effects - advantage, disadvantage and share - with the prospect of developing a general understanding of group choice dynamics, patterns of sentiment emergence, option strengths and weaknesses, and so on, wherever they apply.

Here are some examples of "rule of thumb" relationships concerning the impacts of parameters on share that can be readily confirmed applying Options Analysis simulation procedures:

- **Proximity of option mean appeals.** Closer means and overlapping appeal distributions will reduce the share of the option with the highest average appeal.

- **Size of appeal disparity.** Reducing the appeal disparity of the option with the highest mean appeal, will increase the share of that option. Increasing the appeal disparity of alternative options will increase their share. (But note the paradox involved here and for correlation effects below if an alternative option becomes the option with the highest mean appeal.)

- **The asymmetry of an option's appeal distribution. T**he more negatively skewed the distribution of the option with the highest mean, the greater its share.

- **Correlation between appeal distributions.** The more positive the correlation between appeal distributions which overlap, the greater the share for the option with the highest mean appeal. The less positive the relationship the greater share for the alternative.

Relation of specific factors to generic influences

There are an infinity of possible causes for levels of appeal including the personal histories and experiences of all the individuals involved in making choices. However, it is expected that different types of option variation will yield typical parameter variation profiles impacting on an option's appeal for a specific group. The impact is not expected to be on just one appeal parameter. Rather, any option modification can be expected to change most parameters, but to varying degrees – many barely at all and perhaps one or two substantially. If an option modification has no affect on appeal parameters, there will be no change in advantage, disadvantage and share.

Currently, we know little that is solidly specific about these impact profiles. There is, however, a considerable lore, for example, in sociology, social psychology, politics, marketing, research and development, advertising and corporate communications, on what is of general appeal, what is polarising, divisive, differentiating, stimulating, disenchanting, and so on. It is not difficult to see here the correlates of the generic appeal parameters. Nor is it inherently difficult to appreciate the different possible parameter effects of the principle aspects of any option.

Notes:

Information on changing appeal: For additional information on how to change appeal and associated methods for development and testing of change methods and how to measure change, see ChangingOptionChoice.PDF in accompanying download.

Additional parameter information: For additional details on the meanings and character of parameter effects and changes on appeal distributions, see the ChangeComponents.PDF and AppealAttributesAssociations.PDF in the support materials for the Options Analysis download.

Significance of parameter effects: Commonly, in statistical analysis, parameters such as the standard deviation, skewness, and kurtosis, are used to qualify the mean – to pin it down or show how well or badly a mean represents a distribution. This is not the case in Options Analysis. The term "parameter" here refers to *a characteristic effect*. This is because each type of parameter is a factor altering the alignment of an individual's appeal ratings **in a particular way**. Each parameter associated with a group's appeal distribution differentially affects the "greater than/less than" relations for each individual's option appeal ratings. Thus, each distributional appeal parameter stands as a key potential explanation of an option's advantage, disadvantage or share – either on its own or in combination with other parameters.

Partitioning appeal, advantage and share – Parameter adjustment and change - 1

Appeal parameters and distributions

For any target group, if there were no perceptible differences between options, no measurement errors, and extraneous factors were removed, **all** appeal measurements could be represented by a single point. There would be an equal probability of any of the options being selected. The shares amongst the options would be equal and there would be no advantage or disadvantage between the options. This is the "base model" – no advantage, no disadvantage and equal shares based on equal probabilities of selection for all choosers. Each option would be indistinguishable.

By implication, the differences in appeal parameters (representing sources of systematic differences between the options) create the differences in advantage, disadvantage and share. The parameters achieve this by determining whether the appeal represented by an individual's rating on one option will be higher or lower than that individual's rating on another. It is the character of the option, via its parameter mix, that creates its own peculiar distribution of appeal responses for a particular group.

Similarly, modifying an option may be expected to generate changes in the distribution of appeal for that option. This would affect the positions of individuals relative to their positions on other options. In turn, this will have consequences for individual choices and group shares.

These relationships underlie the two Options Analysis procedures of:

1. parameter adjustment (distributional analysis), and

2. parameter change (simulation).

Partitioning appeal, advantage and share – Parameter adjustment and change – 2

Parameter adjustment

If the differences in parameters are eliminated, then so are the differences in advantage, disadvantage and share. Standardisation of distributional parameters involves systematically changing the relative attractiveness of the options, to make them all the same. In some respects the process may be seen as analogous to ANOVA with its comparison of group and grand means. In this way the effects of parameters can be assessed.

Parameter adjustment involves:

1. taking options, having different positions on a parameter (e.g. different appeal means),

2. standardising their positions so that **all** options are the same on that parameter (e.g. the same mean appeal),

3. then evaluating the consequences of that adjustment for differences in share, advantage and disadvantage (i.e. comparing before with after results for all options: by how much did their share, advantage and disadvantage change?).

In Options Analysis, standardisation of a parameter across all options in a selection set is termed a "parameter adjustment". Standardisation may involve any one or a combination of the following:

1. All option appeal means adjusted to equal the mean of the option means.

2. All option standard deviations adjusted to equal the mean of the standard deviations.

3. All option skewness differences adjusted to equal a skewness of zero i.e. all symmetrical distributions.

4. All option kurtosis differences adjusted to equal a kurtosis of zero i.e. same as a normal distribution.

5. All option deviations from a normal distribution adjusted to approximate a normal distribution. (This normalisation process adjusts for both skewness and kurtosis.)

6. Ratings randomised between options to reduce all inter-option correlations to zero.

Interpretation of parameter adjustments

Parameter adjustments provide positively and negatively valued coefficients of impact in terms of:

1. Percentage points difference in share.

2. Appeal points difference in advantage.

3. Appeal points difference in disadvantage.

The simplest way to interpret these coefficients is to view them as effects of parameter differences amongst options. For example:

Share

•   Option A receives an adjustment of –14% for share after standardisation of means. We can say the differences between option means reduced the share of Option A by 14% points.

•   Option A receives an adjustment of +10% for share after standardisation of standard deviations. We can say that the differences between standard deviations increased the share of Option A by 10% points.

Advantage

•   Option A receives an adjustment of +5 appeal points for advantage after standardising skewness. We can say the differences between option skewness contributed 5 appeal points to the advantage of Option A.

- Option A receives an adjustment of –10 appeal points for advantage after standardisation of means. We can say the differences between option means reduced the advantage of Option A by 10 points.

Disadvantage

- Option A receives an adjustment of –15 appeal points for disadvantage after eliminating inter-alignment effects. We can say that option inter-alignment effects contributed 15 appeal points to the disadvantage of Option A (remembering that disadvantage is a negative scale.)

- Option A receives an adjustment of +5 appeal points for disadvantage after standardisation of kurtosis. We can say that differences in option kurtosis reduced the disadvantage of Option A by 5 appeal points (again remembering that disadvantage is a negative scale.)

A detailed appreciation of any coefficient will at least require a corresponding appreciation of the size and direction of the relevant parameter adjustment. This is especially important as the relationships between parameter adjustments and advantage and share effects may frequently be non-linear. The size of the parameter adjustments are also provided in analysis output.

Example of adjustment analysis

The following table provides the adjustment effects of the mean on appeal, share, advantage, and disadvantage. (The residual 0.4% share is accounted for by unawareness.) Adjustments for a variety of appeal parameters are to be found in ExampleSample.XLS included in the download.

Adjustment effects of the mean				
	Clinton	Dole	Perot	
Adjustment effects on appeal				Averages
Unadjusted mean	59.2	51.8	39.7	50.2
Adjusted mean	50.2	50.2	50.2	50.2
Adjustment	8.9	1.6	-10.5	0.0
Adjustment effects on share				Totals
Unadjusted share	58.1%	31.7%	9.9%	99.6%
Adjusted share	47.6%	27.9%	24.0%	99.6%
Change %	10.5%	3.7%	-14.2%	0.0%
Adjustment effects on advantage				
Unadjusted	17.5	9.4	1.6	
Adjusted	10.9	7.9	4.2	
Difference	6.6	1.5	-2.6	
Adjustment effects on disadvantage				
Unadjusted	-16.6	-24.1	-36.3	
Adjusted	-22.1	-22.5	-22.8	
Difference	5.5	-1.5	-13.5	

Partitioning appeal, advantage and share – Parameter adjustment and change - 3

Parameter change

The term "parameter *adjustment" is used to refer to* **standardisation of a parameter's variation amongst *all* options** across a selection set.

By contrast "parameter *change"* refers to variation of **one or more parameter values for *any* one or more options** in a selection set. Thus, parameter change can be used for simulating "what if" analyses.

"Parameter change" generally involves change you want to make to an option's appeal data to create a new scenario to evaluate the specific effects on a target option and across the selection set. For example, You may change the mean of Option X by adding, say, five appeal points to each case using the Options Analysis simulation option for changing average appeal. Running Options Analysis will then show how your change has affected the share, advantage and disadvantage of *all* options in the analysis.

The usual comparisons are between pre and post-change results or amongst a series of simulated results. The interpretations are similar to those for parameter adjustment except that the consequences are the effects of the specific changes made in the scenario.

The following table shows the effects of changing the mean appeal of Clinton from 59.2 to 50.0 to evaluate the effects on advantage, disadvantage and share. It will be noticed that the results of parameter *change effects* may have different signs from a similar analysis of **adjustment effects**. In change analysis the initial status statistics provide the reference data for calculating change. On the other hand, with adjustment analysis we are trying to explain the results, either explicitly or implicitly, in terms of deviations from the base model i.e. chance shares and zero advantage and disadvantage. Thus, an evaluated adjustment or change effect may be similar but with opposite signs assigned.

Effects of changing Clinton's mean appeal from 59.2 to 50.0				
	Clinton	Dole	Perot	
Change effects on share				Totals
Initial status	58.1%	31.7%	9.9%	99.6%
New Scenario	52.9%	35.1%	11.6%	99.6%
Change %	-5.2%	3.5%	1.7%	-0.0%
Change effects on advantage				
Initial status	17.5	9.4	1.6	
New Scenario	12.7	10.7	2.1	
Difference	-4.8	1.3	0.5	
Change effects on disadvantage				
Initial status	-16.6	-24.1	-36.3	
New Scenario	-20.8	-19.3	-31.5	
Difference	-4.2	4.8	4.8	

More extensive examples of simulation using parameter change are to be found in ExampleAnalysis.XLS contained in the download.

Partitioning appeal, advantage and share – Analytical methods

Differing procedures for applying parameter adjustment or change give different perspectives

The main focus of Options Analysis is analysis of share, advantage and disadvantage within selection sets through the adjustment or change of appeal parameters. The methods available serve varying but related purposes and provide differing perspectives on parameter contributions or change effects.

Here are some examples of the different analyses involving the adjustment or change of parameters which may be performed with Options Analysis:

- Adjust or change a single parameter to evaluate its impacts. (The results show the effects of that parameter assuming that the remaining parameters are unchanged.)

- You can also "simultaneously" standardise or change multiple parameters to evaluate their combined effects.

- Combinations of single or multiple parameters can be adjusted or changed and the results compared with other combinations of parameter adjustment or change.

- Backward or forward hierarchical adjustment analysis involving pairs or sets of parameters can be performed. This can be used to reveal marginal parameter contributions.

- Forward hierarchical adjustment analysis involving multiple parameters can be performed to fully account for the total marginal parameter contributions making up advantage, disadvantage and share.

- Standardisation of single or multiple parameters can be performed to provide controls for the conditional analysis of other parameters to reveal direct and indirect parameter contributions i.e. to analyse parameter entanglements.

- Multiple simulation scenarios can be simultaneously produced to evaluate, for example, a graded series of parameter changes.

- Parameter adjustment analysis can be performed on new simulation scenarios.

While a limited range of named procedures are provided for analysis they are capable of flexible use to perform all the above and more.

Methods for analysis of parameter contributions to appeal, advantage, disadvantage and share

The following sections further cover methods for parameter analysis:

1. **Functional analysis:** For evaluating the effects of any single parameter or any combination of parameters on option advantage, disadvantage and share.

2. **Structural analysis:** For evaluating hierarchical effects of any pair or set of parameters on option advantage, disadvantage and share, applying a forward or backwards ordered moments of distribution parameter analysis.

3. **Entanglement analysis:** Using any one or a combination of Options Analysis methods to evaluate the direct and indirect effects of parameters on option advantage, disadvantage and share.

4. **Simulation analysis:** Applying changes to one or more parameters for one or more options to create new scenarios and evaluate the projected effects on option advantage, disadvantage and share.

Interpretation of parameter adjustments and conditional or ordered adjustments

Functional, structural and entanglement analysis are concerned with evaluating the total, separate and joint contributions of parameters to advantage, disadvantage and share:

- ***Total parameter effects*** are concerned with the gross contributions of each parameter i.e. without separately accounting for interrelationships with other parameters.

- Analysis of separate effects may focus on the ***unique contribution*** of a particular parameter or, alternatively, be concerned just with the ***specific*** contribution one parameter makes amongst a selection of two or more parameters.

- ***Joint contributions*** may be viewed as the product of "interactions" amongst the parameters or as the results of parameter entanglements.

In addition to gross parameter contributions, two general patterns of parameter contribution can be formally identified and are referred to in the following sections:

1. **Direct and indirect parameter contributions.** "Direct effects" refers to the unique impacts associated with each parameter alone while "indirect effects" refers to those impacts generated by one parameter in association with other parameters. Direct and indirect effects make up the total effects of each parameter. Furthermore, adjustment analysis results for any group of parameters will take account of their total joint direct and indirect effects. However, identifying the direct effects of any parameter requires that all the remaining potentially entangled parameters be controlled. The indirect effects are the residual of the total effects less the direct effects.

2. **Independent and shared parameter contributions.** "Independent effects" may be taken to refer to those parameter impacts attributable solely to one parameter amongst others included in any particular analysis or a particular step in a hierarchical analysis. Independent effects always include the direct parameter effects. In addition to the implicit direct effects, independent effects may also include some indirect effects by linkage to one or more parameters not controlled in the analysis but to which the remaining controls are not linked. It will be readily appreciated that, most commonly, independent effects will be substantially composed of direct effects and the distinction of independent and shared effects from direct and indirect effects will be a fine one. "Shared effects" are impacts not identified solely with one parameter. Shared effects are always indirect effects.

Understanding conditional or ordering effects on parameter analysis results is important. They will apply to any implicit or explicit ordered application of functional or structural parameter analysis to parameters or sets of parameters. They provide the basis for insights on the relations between parameters.

Partitioning appeal, advantage and share – Functional analysis

Basic functional adjustment analysis

With functional adjustment analysis you can standardise on the following parameters to evaluate their effects on advantage, disadvantage and share:

1. Means

2. Standard deviations

3. Skewness

4. Kurtosis

5. Normalisation (to standardise for both skewness and kurtosis simultaneously).

6. Randomisation (to reduce correlations between options to zero).

Separate or combined analysis

Each functional analysis shows how much share, advantage, and disadvantage of each option is attributable to:

- each parameter in **separate** parameter analysis, **or**

- to the joint effects of the parameters selected in a **combined** parameter analysis.

We may be interested in the effects of individual parameters. Any or all parameters may be selected in a single run to produce independent results for each.

Alternatively, two or more parameters can be selected for a multiple parameter analysis. In this case a single analysis is produced for the combined effects of the selected parameters.

Here are the summary share results from a single functional analysis run. Each line represents the results of an independent analysis of the target parameter. The coefficients show the contribution of each parameter to unadjusted share. A full analysis, including results for advantage and disadvantage, is to be found in ExampleAnalysis.XLS included in the download materials.

Separate functional adjustment effects of parameters on share			
	Clinton	Dole	Perot
Unadjusted share	58.1%	31.7%	9.9%
Means adjustment	10.5%	3.7%	-14.2%
Std deviation adjustment	0.4%	3.2%	-3.7%
Skewness adjustment	4.5%	-5.1%	0.6%
Kurtosis adjustment	-2.3%	1.6%	0.7%
Correlation (randomised) adjustment	3.3%	0.0%	-3.7%

While the mean is clearly the single most important factor, each of the others also has one or two significant impacts on shares. What is not revealed by the functional analysis of each parameter, separately, is the extent to which results are dependent on inter-relationships between each test parameter and the remaining parameters.

Here is a comparison of a **combined** functional analysis for mean and skewness effects on share with the totals for their separate effects (assuming, momentarily, that they are additive) from the above table.

Comparison of combined and separate functional adjustment effects of means and skewness on share			
	Clinton	Dole	Perot
Combined means and skewness adjustment effects	17.5%	0.7%	-18.2%
Assumed additive means & skewness effects	15.0%	-1.4%	-13.6%
Differences between models	2.5%	2.1%	-4.6%

The results show substantive differences between the models which would suggest the need to explore the conditional or entangled relationships of these parameters. (At the same time it would be wise to investigate entanglements with the remaining parameters to which they may both be related.)

Conditional parameter analysis

More advanced research using functional analysis may involve the introduction of controls. Here, the effect of a parameter can be evaluated after the data have been adjusted for one or more other parameters to remove shared entangled effects. To do this, you can:

1. Run a functional analysis on one or more control parameters and request casewise output of the results.

2. The adjusted appeal output listing of cases can then be re-run (without casewise re-adjustment), standardising on one or more test parameters, to assess the conditional changes.

Comparison of effects of mean on share before and after adjusting for skewness			
	Clinton	Dole	Perot
Means adjustment	10.5%	3.7%	-14.2%
Means adjustment after controlling for skewness effects	13.0%	5.7%	-18.8%
Differences show impact of skewness on mean	-2.5%	-2.0%	4.6%

Similar objectives to conditional analysis may be more readily achieved using structural analysis which automatically provides data on marginal parameter contributions.

Additional coverage of conditional and ordered analysis is to be found in the following sections on structural analysis and parameter entanglement.

Note on randomisation: While the estimates for share adjustment produced by randomisation may be taken at face value, the adjustments for advantage and disadvantage will probably be underestimates of the full correlational effects. Randomisation is basically a "re-sorting" rather than an adjustment procedure in the sense of the other parameter adjustments and is thus not capable of fully reflecting advantage and disadvantage adjustments for large negative and positive option inter-correlation.

Partitioning appeal, advantage and share – Structural analysis – 1

Analysing marginal and total contributions

In structural analysis we can take appeal ratings for a sample (that would usually have been adjusted casewise), and progressively adjust the data step-by-step for each parameter type across the options. This means we can evaluate the marginal consequences for advantage and share at each adjustment step. The results show the incremental contributions of parameters to share, advantage and disadvantage for each option in the selection set.

One of the two approaches to a *full* hierarchical structural analysis uses the following ordered step-by-step process of parameter adjustments:

1. Means

2. Standard deviations

3. Skewness

4. Kurtosis

5. Correlation (through inter-alignment or randomisation)

The alternative approach performs the analysis in the reverse order.

The ordering, from means to correlations, or its reverse, has particular significance since it systematically embraces the "moments" approach to distributional analysis. Moving from means to correlations may be seen as progressing from the general to the particular through a "data reduction" process.

Ranging and enzymatic structural analysis

The strictly ordered forward and backward processes underlie all structural analysis and are called:

• **Ranging analysis** when proceeding in forward order.

• **Enzymatic analysis** when using the reverse order.

In ranging analysis, higher-order parameters may be viewed as controlling the range of influence of the lower-order parameters on shared effects.

In enzymatic analysis, lower-order parameters may be seen as catalysing or inhibiting the effects of higher-order parameters on shared effects.

While the order of the parameters are fixed, ranging and enzymatic analysis are *not* limited to adjacent parameters in the list.

In *any* kind of ordered analysis of parameter effects, the interpretations are the same. Parameters adjusted earlier will include both their own direct effects and any indirect effects associated with other parameters. This applies to *both* explicit or implicit forward or backwards analysis, and includes implicit ordering such as in controlling one or more parameters before analysis of others.

Procedures for full structural analysis of ranging and enzymatic parameters

The following tables apply to the analysis of advantage, disadvantage and share, respectively.

Procedure for a full structural **ranging** analysis of parameters effects					
Analysis number	Target parameter	Hierarchical parameter controls				Ranging effects
1	Mean					M direct and indirect
2	Std deviation	M				SD direct and residual indirect
3	Skewness	M	SD			S direct and residual indirect
4	Kurtosis	M	SD	S		K direct and residual indirect
5	Correlation & idiosyncratic	M	SD	S	K	Inter-alignment equals R direct plus idiosyncratic residual

In ranging analysis, any share effects attributable to the inter-alignment adjustment are attributable to correlation effects alone. However, the advantage and disadvantage effects will be the mixed results of both correlation and idiosyncratic effects. Some assessment of their separate effects may be obtained by including a randomisation analysis.

Procedure for a full structural **enzymatic** analysis of parameters effects						
Analysis number	Target parameter	Hierarchical parameter controls					Enzymatic effects
1	Correlation						R direct and indirect effects of randomisation.
2	Kurtosis	R					K direct and residual indirect
3	Skewness	R	K				S direct and residual indirect
4	Std deviation	R	K	S			SD direct and residual indirect
5	Mean	R	K	S	SD		M direct
6	Idiosyncrasy+	R	K	S	SD	M	Residual is idiosyncrasy plus any residual R effects.

Summary results for structural enzymatic analysis show only the joint correlation and inter-alignment results while the detailed results show the separate output for each. The joint results are more accurate and show the full correlation effects on share (as the randomisation process may not account for all the correlation effects). The separate analyses provide only estimates of the advantage and disadvantage effects and may be treated with some caution.

Partitioning appeal, advantage and share – Structural analysis – 2

Full structural adjustment analysis

An important purpose of structural analysis is to show how the parameter building blocks make up the difference between current shares and the "base model" share. Similarly, all advantage and disadvantage can be accounted for.

The base model share is 100% divided by the number of options in the selection set i.e. each option has an equal chance of being chosen and, therefore, has an equal share. The base model assumes there are no differences between the options, and, that systematic option differences are responsible for differences in share of choice, advantage and disadvantage.

By including a full set of adjustments the ordered incremental approach can be used to account for all variation in appeal. For example in a ranging analysis, standardising averages in a selection set first will centre all the lower order parameters about the grand mean. Similarly, making all the standard deviations the same keeps disparity constant across the comparisons for skewness and kurtosis. Standardising skewness will enable comparisons of kurtosis across distributions that are all symmetric. Further, standardising kurtosis on zero will make all the distributions normal. And, all these adjustments allow an even footing for correlational and idiosyncratic comparisons. At each stage what remain are any marginal contributions.

To fully account for share, blocked cases must also be added. The figures provided for ranging analysis blockage effects will be correct and are labelled "Blockage adjustment" in the output. This will not be so for any ranging or enzymatic analysis which includes randomisation. This is because randomisation redistributes casewise multiple option blockage across cases so they are likely to become cases of single option blockage. When randomisation is included, the residual associated with blockage is labelled "Base model deviation" which is accounted for by blockage plus blockage errors generated by randomisation.

For example, cases unaware of all options are an extreme example. In practice, cases unaware of all options will usually be nominated as aware of at least one option through randomisation. This will result in any unallocated share attributable to total unawareness being allocated and attributed to the effect of randomisation. Obviously, this result is not correct. This can be avoided by filtering out such cases before proceeding with an analysis using randomisation.

A full structural analysis would show a step-by-step parameter decomposition of share, advantage and disadvantage. Of course, the results will differ depending on whether a ranging or enzymatic analysis is selected and the character of parameter entanglements. A comparison of the results of the two types of analysis may be enlightening.

Here are the summary share results for structural ranging and enzymatic parameter analyses. Each line shows the marginal contributions of each parameter to unadjusted share. The marginal contributions for the distributional parameters are read from top to bottom for the ranging analysis, and, from bottom to top for the enzymatic analysis of share. Full analyses, including results for advantage and disadvantage, are to be found in ExampleAnalysis.XLS included in the Options Analysis download materials.

Hierarchical **ranging** analysis of effects on share				
	Clinton	Dole	Perot	Totals
Unadjusted share	58.1%	31.7%	9.9%	99.6%
Means adjustment	10.5%	3.7%	-14.2%	0.0%
Standard deviation adjustment	6.0%	0.4%	-6.4%	0.0%
Skewness adjustment	3.1%	-2.1%	-1.0%	0.0%
Kurtosis adjustment	1.3%	-0.3%	-1.1%	0.0%
Inter-alignment (correlation) adjustment	3.0%	-3.1%	0.1%	0.0%
Blockage adjustment	0.8%	-0.3%	-1.0%	-0.4%
Base model	33.3%	33.3%	33.3%	100.0%

Hierarchical **enzymatic** analysis of effects on share				
	Clinton	Dole	Perot	Totals
Unadjusted share	58.1%	31.7%	9.9%	99.6%
Means adjustment	18.6%	-0.8%	-17.8%	0.0%
Standard deviation adjustment	0.9%	1.4%	-2.3%	0.0%
Skewness adjustment	2.2%	-2.2%	0.0%	-0.0%
Kurtosis adjustment	-0.8%	0.1%	0.5%	0.0%
Inter-alignment (correlation) adjustment	2.8%	0.2%	-3.1%	-0.4%
Base model deviation	0.8%	-0.0%	-0.7%	-0.0%
Base model	33.3%	33.3%	33.3%	100.0%

Partitioning appeal, advantage and share – Structural analysis – 3

Procedures for partial structural analysis of ranging and enzymatic parameters

Partial hierarchical ranging and enzymatic analyses follow the same steps shown above except that controls are only included for higher or lower order target parameters for ranging and enzymatic analysis, respectively. For example, in a ranging analysis of standard deviations and kurtosis, the only control included would be for the standard deviation in the analysis of kurtosis.

Special consideration is needed for the analysis that includes inter-alignment. This is because inter-alignment will include *all* the effects of *all* the parameters not included in the analysis because it calculates and accounts for all the residual advantage and disadvantage.

Analysis of selected parameters

Any one, two or more parameters may be selected for a structural analysis. The order of analysis will be determined by selecting from the ranging or enzymatic analysis options.

This can be useful for the analysis of, say, pairs of parameters. By performing both ranging and enzymatic analyses for both parameters, the effects of adjusting any one parameter before or after another will enable separation of their independent and shared effects. (The results are effectively the same as those referred to under "conditional parameter analysis" in the section on functional analysis. There is further discussion on this in the next section on entanglement.)

The following table shows how to separate the independent and shared effects of appeal mean and skewness. After controlling for the prior parameter the independent effects are provided: the skewness results from the ranging analysis and the mean results from the enzymatic analysis. The shared effects are simply the differences between the sum of the independent effects and the total joint effects for the mean and skewness.

Using structural analysis for computing direct and indirect effects on share of means and skewness				
	Clinton	Dole	Perot	Totals
Ranging adjustment effects on share				
Means adjustment	10.5%	3.7%	-14.2%	0.0%
Skewness adjustment	7.0%	-3.1%	-4.0%	0.0%
Totals	17.5%	0.7%	-18.2%	0.0%
Enzymatic adjustment effects on share				
Means adjustment	13.0%	5.7%	-18.8%	0.0%
Skewness adjustment	4.5%	-5.1%	0.6%	0.0%
Totals	17.5%	0.7%	-18.2%	0.0%
Direct and indirect effects on share				
Independent effects of mean	13.0%	5.7%	-18.8%	-0.0%
Independent effects of skewness	7.0%	-3.1%	-4.0%	-0.0%
Shared effects of means and skewness	-2.5%	-1.9%	4.6%	0.0%
Totals	17.5%	0.7%	-18.2%	0.0%

Another important application of partial analysis involves a review of influences on a particular parameter by multiple parameters. For example, it may be of concern to appreciate how other parameters modify the effects of the mean. Here, either ranging or enzymatic analysis would include some or all parameters **other than the mean** i.e. the means are left unmodified. (Exclude inter-alignment from the analysis as this will incorporate the effects of the means you wish to exclude.) If you wish to include correlational effects then check randomisation analysis.

For most structural analysis a "base model deviation" is reported. This shows the difference between the base advantage, disadvantage and share, respectively, and that accounted for by the parameters included in the analysis.

The role of inter-alignment and adjustment for correlation effects

When inter-alignment is included in an analysis, inter-alignment adjustment will always account for **all** residual advantage and disadvantage (including that associated with idiosyncrasy) and share associated with appeal.

When included in a **full ranging structural analysis** inter-alignment will account **only** for correlational and idiosyncratic effects, because of the prior effect extraction of the remaining parameters. The correlational and idiosyncratic components of advantage and disadvantage are not strictly separable. However, since idiosyncratic appeal is random, any change in shares is attributable **solely** to correlation effects. This full ranging structural analysis is the result of arithmetic parameter adjustment. No randomisation processes are used.

It is possible to obtain a separate estimate of the contribution of correlation effects to advantage and disadvantage, (even though the adjustments will probably be underestimates), by also including a randomisation analysis. The combined inter-alignment and correlational effects will be found in the summary tables but the supporting output will include the separate analysis of randomisation and inter-alignment effects from which the summary totals are derived.

The combined randomisation and inter-alignment estimates may not exactly equal the inter-alignment totals for an analysis not including randomisation. The reason is that randomisation can also affect the blockage result by disassociating cases with blockage of multiple or all options, if these have not been filtered.

For a **partial ranging analysis**, as inter-alignment covers **all** residual appeal variation (including that for all unadjusted parameters), a separate assessment of correlation effects can be obtained by checking the randomisation option and excluding inter-alignment adjustment. This randomisation within structural ranging analysis will be completed after the other selected parameters have been adjusted. Here, only the randomisation results and residuals are subject to the effects of sampling variation that randomisation involves.

On the other hand, a **full enzymatic structural analysis** <u>begins</u> by attempting to reduce correlation effects to zero through randomisation of option appeal ratings between respondents. As a result, this and all subsequent steps are subject to the effects of random sampling variation. The same applies to all partial enzymatic structural analysis where randomisation is selected.

In fact, any analysis involving randomisation, will, because the effects of random sorting, produce results consequent to the randomisation process, that vary from one analysis to another.

Examination of the separate results for randomisation and inter-alignment, will show whether a re-run of the analysis is advisable on account of the residual **shares** for inter-alignment deviating substantially from zero. Because of its effects on other parameter adjustments, this deviation is of greater significance in enzymatic analysis.

Note on skewness and kurtosis: As with functional analysis, normalisation is available as a substitute for standardising skewness and kurtosis. While it is faster, it provides less satisfactory adjustment (especially for kurtosis) and does not reveal their separate effects.

Partitioning appeal, advantage and share – Parameter entanglement

The following sections on entanglement add considerable complexity to the preceding sections. Unless this is of special interest, the reader is advised to skip to the section: Partitioning appeal, advantage and share – Simulation analysis.

Views of entanglement

Straightforward application of functional and structural analysis involves review of the effects of "whole" parameters, even if only of their marginal effects. The concept of "parameter entanglement" implies a deeper level of analysis and a wish to appreciate the makeup of an important source of non-linear effects.

Entanglement involves a perspective of parameters behaving in combination with other parameters, or, as having conditional effects dependent on other parameters. For either interpretation, entanglement analysis involves partition of a parameter's consequences into direct and indirect effects. The partition can be extended to of a decomposition of a parameter's indirect effects amongst other parameters. This can be extended further still to a decomposition of the *mutual* entanglements amongst a group of parameters.

While directly programmed methods are not currently provided for entanglement analysis, both functional and structural analysis, especially the former, can be used, semi-iteratively, to provide these results. Entanglement analysis is usually applied to understand a given parameter configuration of special interest. Of course, to gain an insight into the dynamic entanglement effects of changing a parameter, Options Analysis simulated series analysis is able to be applied.

Entanglement examples

Here is an example involving the mean and standard deviation of one option. When that option has the highest mean in a selection set, a narrow standard deviation will lead to more cases assigning their highest rating to the option. This will enhance its share. On the other hand, if the option had the lowest mean appeal but retained its narrow standard deviation, the chances of cases obtaining highest appeal would be reduced and its share would be more degraded. Both results depend *jointly* on both the mean and the standard deviation. (Advantage and disadvantage are also affected by such entanglements, although not necessarily in the same direction or to the same extent as share. There is nothing inconsistent about advantage decreasing and share increasing, or vice versa.)

Correlation may be a common source of entanglement. The more positive the correlation between options, the more movement in shares between them is facilitated. On the other hand, negative correlations will inhibit movement. While these are underlying propensities, what actually happens will depend on the remaining parameters with the outcome most commonly a joint effect.

The significance of entanglements

It is not currently known whether selection sets display "characteristic" configurations of entanglement about which it would be possible to make generalisations concerning, for example, strategy and tactics for change. Implied here is the possibility of emergent repeated parameter configuration patterns associated generally with the dynamics of change. This is one key area for the future application of Options Analysis concepts. Such "profiles" could be very important for the more ready understanding and management of options in relation to economic markets, public opinion, product and service development, etc.

From the perspective of the promoters of any one option, a desired parameter configuration within a specific selection set may be appropriately regarded as a share and advantage strategy.

Blockage and idiosyncrasy have only direct effects

Blockage has only a direct effect on choice and share. It has no meaning with respect to appeal, advantage and disadvantage and is thereby isolated from the associated effects with other parameters. As it has no indirect effects it need not be considered in relation to parameter entanglement.

Idiosyncrasy effects are only isolated as the random residuals for rated options after the effects of means, standard deviations, skewness, kurtosis and correlation have been removed. Idiosyncrasy data are akin to the residuals of multiple regression, but, substantively, it is casewise unique appeal within the selection

set. The influence of idiosyncrasy is unassociated with the effects of other parameters on shares of choice.

Direct and indirect effects of entangled parameters

Entangled parameters include option means, standard deviations, skewness, kurtosis and correlations. They may express **both** direct **and** indirect effects on advantage, disadvantage and share. This means that a **complete** understanding of factors affecting share and advantage depends on an appreciation of the roles of most parameters across a selection set. The potential for both direct and indirect effects substantially increases the ways an option may change or affect share or advantage objectives.

A parameter's **direct effects** on advantage, disadvantage and share are solely attributable to that parameter alone. Direct parameter effects are present where there are no differences between other parameters over a set of options. More commonly, a parameter may be expected to exhibit both direct and indirect effects. The direct effects of a specific parameter can be determined by standardising other entangled parameters then running the resulting casewise results on the target parameter.

To find total, direct and indirect contributions to options for the standard deviation, for example:

1. Run a functional analysis for the standard deviation alone. This will provide the total effects for advantage, disadvantage and share within the selection set.

2. Run a **combined** functional parameter adjustment analysis for means, skewness, kurtosis and randomisation requesting a casewise listing of results.

3. Select the adjusted case-listed results, and, without casewise re-adjustment, re-run the functional analysis for the standard deviation alone. The results show the standard deviation's direct effects on advantage, disadvantage and share.

4. The indirect effects for the standard deviations can be found simply by subtracting the direct effects result from the total effects.

The size of a parameter's total effects does not necessarily reflect the scale of direct and indirect impacts. Direct and indirect effects may be different in direction and cancel each other.

Here are the share results of such an analysis for the means for the sample found in ExampleSample.XLS included in the download materials. (The same analysis applies to advantage and disadvantage.)

Effects of mean appeal differences on shares			
	Clinton	Dole	Perot
Direct	+19.3%	-1.2%	-18.1%
Indirect	-8.8%	+4.9%	+3.9%
Totals	+10.5%	+3.7%	-14.2%

Parameter decomposition of entanglement effects

Parameter decomposition is useful for identifying both the specific parameter sources and scales of entanglement effects.

There are two different approaches to this analysis. These are referred to as "factorial" and "hierarchical". The hierarchical approach includes "ranging" and "enzymatic" methods.

Factorial entanglement analysis may be viewed as a sub-analysis of the basic functional analysis results. In other words, the results of a complete factorial entanglement analysis for a parameter will sum to equal that parameter's effects as shown in functional analysis. Similarly, hierarchical ranging and enzymatic entanglement analysis are forms of sub-analysis of structural ranging and enzymatic analysis, respectively, and the sums of their entanglements will equal the results of those analyses.

Partitioning appeal, advantage and share – Factorial entanglement analysis - 1

The factorial approach involves separate analysis of the direct effects and the single and multiple parameter indirect effects with any one target parameter. Each contribution to the target parameter is independent of other contributions i.e. the separate contributions to the target parameter are additive.

However, like the separate parameter results for a functional analysis, the results for each target parameter are not independent of each other. For example, if a mean target parameter analysis has the standard deviation making an entangled contribution, so also, it is to be expected that analysis of the standard deviation as a target parameter will yield an entangled mean.

Factorial parameter entanglement analysis of a target parameter is analogous to factorial ANOVA. ANOVA's "main effects" are here referred to as "direct effects" and "interaction effects" as "indirect effects".

The approach is potentially complex and extensive with up to four levels of interaction effects to be explored and interpreted. Its application to the target analysis of all parameters would not generally be warranted. However, there can be value in analysis of contributions to target parameters of special interest.

The direct and indirect parameter interaction results can be assembled through multiple runs using functional analysis. The following table lists the functional analysis runs required for direct and single-level interaction results. Control for correlations is obtained by using the randomisation option. Each line in the table represents two functional analysis runs as described below. Here are the steps for the analysis of each line.

1. Run a **combined** functional analysis for the control parameters (using casewise adjusted data) and output a casewise listing of the results.

2. Run a target parameter analysis on the control adjusted results (without any further casewise adjustment).

3. If the results are for indirect contribution effects then perform the subtractions, for advantage, disadvantage and share, respectively, as indicated in the last column (if you want results for all three).

…

Analysis number	Target parameter	Control parameters	Entanglement effects (Nos. are analysis nos.)
1	Mean	StdDev, Skew, Kurt, Corr	Mean direct
2		Skew, Kurt, Corr	StdDev = 2 - 1
3		StdDev, Kurt, Corr	Skew = 3 - 1
4		StdDev, Skew, Corr	Kurt = 4 - 1
5		StdDev, Skew, Kurt	Corr = 5 - 1

Analysis number	Target parameter	Control parameters	Entanglement effects (Nos. are analysis nos.)
6	Std deviation	Mean, Skew, Kurt, Corr	StdDev direct
7		Skew, Kurt, Corr	Mean = 7 − 6
8		Mean, Kurt, Corr	Skew = 8 − 6
9		Mean, Skew, Corr	Kurt = 9 − 6
10		Mean, Skew, Kurt	Corr = 10 − 6

Analysis number	Target parameter	Control parameters	Entanglement effects (Nos. are analysis nos.)
11	Skewness	Mean, StdDev, Kurt, Corr	Skewness direct
12		StdDev, Kurt, Corr	Mean = 12 − 11
13		Mean, Kurt, Corr	StdDev = 13 − 11
14		Mean, StdDev, Corr	Kurt = 14 − 11
15		Mean, StdDev, Kurt	Corr = 15 − 11

Analysis number	Target parameter	Control parameters	Entanglement effects (Nos. are analysis nos.)
16	Kurtosis	Mean, StdDev, Skew, Corr	Kurtosis direct
17		StdDev, Skew, Corr	Mean = 17 − 16
18		Mean, Skew, Corr	StdDev = 18 − 16
19		Mean, StdDev, Corr	Skew = 19 − 16
20		Mean, StdDev, Skew	Corr = 20 − 16

Analysis number	Target parameter	Control parameters	Entanglement effects (Nos. are analysis nos.)
21	Correlation	Mean, StdDev, Skew, Kurt	Correlation direct
22		StdDev, Skew, Kurt	Mean = 22 − 21
23		Mean, Skew, Kurt	StdDev = 23 − 21
24		Mean, StdDev, Kurt	Skew = 24 − 21
25		Mean, StdDev, Skew	Kurt = 25 − 21

The completeness of any target parameter analysis to any given level can be evaluated by adding parameter contributions and subtracting the total from the results of an uncontrolled functional analysis for the target parameter. This applies to advantage, disadvantage and share, respectively. Any differences would be attributable to higher-order indirect effects on that parameter. Alternatively, if the parameter's effects have been separated into direct and indirect, the sum for the separate indirect effects can be subtracted from the total indirect effects. The differences will be the same.

Here are the share results for an analysis of direct and first level entanglement effects for the means using the sample found in ExampleSample.XLS included in the Options Analysis download. It can be seen that there are important unanalysed entanglement effects from higher-order interactions.

Mean appeal parameter first level entanglement effects on shares			
	Clinton	Dole	Perot
Direct	+19.3%	-1.2%	-18.1%
Indirect	-8.8%	+4.9%	+3.9%
Std deviation	-1.8	1.8	0
Skewness	-0.1	0.1	0
Kurtosis	-0.8	0.7	0.1
Correlation	-1.6	0.6	1.0
Residual indirect	-4.5	1.7	2.8
Total	+10.5%	+3.7%	-14.2%

Partitioning appeal, advantage and share – Factorial entanglement analysis – 2

The following table provides a complete listing of all entanglement analyses for any selected target parameter. To perform a target parameter analysis:

1. Choose your target parameter.

2. Look at the columns headed "Control parameters". Any line in which your target parameter appears is a candidate for the target parameter analysis. You may stop analysis at any level.

3. For any selected analysis line run a **combined** functional parameter adjustment analysis for all the parameters named in the line **except** for the target parameter, and request a casewise listing of results.

4. Run a target parameter analysis on the control adjusted casewise results (without any further casewise adjustment). The results will show the target parameter's controlled effects on advantage and disadvantage and share.

5. To obtain the independent entanglement contributions, calculate the adjustments in the last column for advantage, disadvantage and share, respectively, (that is, if you want results for all three).

…

Note on randomisation: Random variability of results will occur on account of the randomisation process used to control correlation effects. This can be minimised by the use of a single "pre-randomised" set of data to be used in the calculation of all lines involving control for correlation (but not when correlation is a target parameter). Not only will this provide greater sample consistency but it will also speed up calculation.

Work table for extended factorial analysis of parameter entanglements with any selected target parameter								
Interaction effect level	Analysis number	Target parameter	Control parameters for target (Select target in any row and the remaining parameters are controls)					Entanglement effects (Changes from marginal effects results for numbered analyses)
Direct	1	Select	M	SD	S	K	R	Target parameter direct effects only
First Level	2	Select		SD	S	K	R	M=2-1
	3	Select	M		S	K	R	SD=3-1
	4	Select	M	SD		K	R	S=4-1
	5	Select	M	SD	S		R	K=5-1
	6	Select	M	SD	S	K		R=6-1
Second Level	7	Select			S	K	R	M,SD=7-(1+2+3)
	8	Select		SD		K	R	M,S=8-(1+2+4)
	9	Select		SD	S		R	M,K=9-(1+2+5)
	10	Select		SD	S	K		M,R=10-(1+2+6)
	11	Select	M			K	R	SD,S=11-(1+3+4)
	12	Select	M			S	R	SD,K=12-(1+3+5)
	13	Select	M			S	K	SD,R=13-(1+3+6)
	14	Select	M	SD			R	S,K=14-(1+4+5)
	15	Select	M	SD			K	S,R=15-(1+4+6)
	16	Select	M	SD	S			K,R=16-(1+5+6)
Third Level	17	Select				K	R	M,SD,S=17-(1+2+3+4+7+8+9)
	18	Select			S		R	M,SD,K=18-(1+2+3+5+7+9+12)
	19	Select			S	K		M,SD,R=19-(1+2+3+6+7+10+13)
	20	Select		SD			R	M,S,K=20-(1+2+4+5+8+9+14)
	21	Select		SD		K		M,S,R=21-(1+2+4+6+8+10+15)
	22	Select		SD	S			M,K,R=22-(1+2+5+6+9+10+16)
	23	Select	M				R	SD,S,K=23-(1+3+4+5+11+12+14)
	24	Select	M			K		SD,S,R=24-(1+3+4+6+11+13+16)
	25	Select	M		S			SD,K,R=25-(1+3+5+6+12+13+16)
	26	Select	M	SD				S,K,R=26-(1+4+5+6+14+15+16)
Fourth Level (No controls for targets)	27	Select	M					SD,S,K,R= 27-(1+3+4+5+6+11+12+13+14+15+16+23+24+25+26)
	28	Select		SD				M,S,K,R= 28-(1+2+4+5+6+8+9+10+14+15+16+20+21+22+26)
	29	Select			S			M,SD,K,R=29-(1+2+3+5+6+7+9+10+12+13+16+18+19+22+25)
	30	Select				K		M,SD,S,R=30-(1+2+3+4+6+7+8+10+11+13+15+17+19+21+24)
	31	Select					R	M,SD,S,K=31-(1+2+3+4+5+7+8+9+11+ 12+14+17+18+20+23)

Partitioning appeal, advantage and share – Hierarchical entanglement analysis - 1

Hierarchical analysis involves application of the stepwise forward (ranging) or backward (enzymatic) approach akin to that provided by structural parameter analysis. Each additional control parameter accounts for maximum possible residual effects i.e. each parameter accounts for both direct and indirect effects not already taken into account. A complete analysis will account for the total effects of all parameters. Consequently, this approach takes account of hierarchical contributions **both within and between** target parameters. (By contrast, factorial entanglement analysis only accounts for contributions **within** each target parameter analysis.)

As with all hierarchical analyses, parameters appearing earlier in any analysis will account for effects entangled with parameters analysed later in the analysis. However, by contrast with structural analysis, analysis of hierarchical entanglements will assist in identifying the roles of interacting parameters. Also, a comparison of results for ranging and enzymatic entanglement analyses may be helpful in revealing further underlying parameter roles (which might alternatively be revealed in (a more extensive) factorial entanglement analysis).

A complete solution for both ranging and enzymatic entanglement analysis appears obtainable by the calculation of only one of these two types. If the advantage, disadvantage or share results for a ranging analysis are cast into a matrix for a single option, with rows and columns representing the parameters. The diagonal cells contain the direct effects. The enzymatic results can be obtained by transposing a copy of the off-diagonal elements into the empty cells. The results above the diagonal will show the enzymatic entanglement effects while those below the diagonal are the ranging entanglement effects.

Performing ranging analysis as the basic reference analysis is likely to yield more stable results than enzymatic analysis because of role played by randomisation is less central.

The direct and indirect hierarchical parameter interaction results can be assembled through multiple runs using functional analysis. The following tables list the functional analysis runs required for hierarchical ranging and enzymatic interaction results. Control for correlations is obtained by using the randomisation option. Each line in the table represents two functional analysis runs as described below. Here are the steps for the analysis of each line.

1. Run a **combined** functional analysis including **both** hierarchical and target control parameters (using casewise adjusted data) and output a casewise listing of the results.

2. Run a target parameter analysis on the control adjusted results (without any further casewise adjustment).

3. If the results are for indirect contribution effects then perform the subtractions, for advantage, disadvantage and share, respectively, as indicated in the last column (if you want results for all three).

…

Work table for full hierarchical **ranging** analysis of entanglement effects of parameters with target parameters									
Analysis number	Target parameter	Hierarchical parameter controls				Target parameter Controls				Entanglement effects (Nos. are analysis nos.)
1	M					SD	S	K	R	M direct
2							S	K	R	SD = 2 – 1
3								K	R	S = 3 – 2
4									R	K = 4 – 3
5										R = 5 – 4
6	SD	M					S	K	R	SD direct
7		M						K	R	S = 7 – 6
8		M							R	K = 8 – 7
9		M								R = 9 – 8
10	S	M	SD					K	R	S direct
11		M	SD						R	K = 11 – 10
12		M	SD							R = 12 – 11
13	K	M	SD	S					R	K direct
14		M	SD	S						R = 14 – 13
15	R	M	SD	S	K					R direct

Work table for full hierarchical **enzymatic** analysis of entanglement effects of parameters with target parameters										
Analysis number	Target parameter	Hierarchical controls					Parameter controls				Entanglement effects (Nos. are analysis nos.)
1	R						M	SD	S	K	R direct
2							M	SD	S		K = 2 - 1
3							M	SD			S = 3 - 2
4							M				SD = 4 - 3
5											M = 5 - 4
6	K					R	M	SD	S		K direct
7						R	M	SD			S = 7 - 6
8						R	M				SD = 8 - 7
9						R					M = 9 - 8
10	S				K	R	M	SD			S direct
11					K	R	M				SD = 11 - 10
12					K	R					M = 12 - 11
13	SD			S	K	R	M				SD direct
14				S	K	R					M = 14 - 13
15	M		SD	S	K	R					M direct

Depending on your purpose, it is not essential to perform a complete entanglement analysis. Any one or more parameters can be omitted. Of course the effects of any uncontrolled parameters will still be present and simply regarded as "given". For example, it may be useful for application purposes to accept inter-option correlations as "unchangeable" and to examine the remaining entanglements in that light. For any line not included in an analysis it would be necessary to change the calculation shown in the last column to refer to the last line of analysis performed. The last line in each target parameter calculation block (where there are no parameter controls) becomes the adjustment for the final parameter in the series.

Note on conditional analysis: For an analysis having only two or three options, the conditional results for any line can be obtained in a single run. Here, any test parameter or parameters are included, in the usual way, in the functional analysis basic dialog. In addition, you specify the control parameters for options in the functional analysis simulation change dialog. (The control parameter input data can be obtained by running a Options Analysis fundamentals analysis on the option selection set. The appropriate data are the global parameter averages produced for the casewise adjusted results.)

Note on randomisation: Random variability of results will occur on account of the randomisation process used to control correlation effects. This can be minimised by the use of a single "pre-randomised" set of data to be used in the calculation of all lines involving control for correlation (but not when correlation is a target parameter). Not only will this provide greater sample consistency but it will also speed up calculation.…

Partitioning appeal, advantage and share – Hierarchical entanglement analysis - 2

Here are the share results for an analysis of both hierarchical ranging and enzymatic entanglement analysis using the sample found in ExampleSample.XLS included in the download materials.

The direct parameter effects are shown in the diagonal cells, the ranging results are below the diagonal, and the enzymatic entanglement results above. The row parameters show the entanglement contributions, in terms of percentage points change, to the column parameters.

The direct, ranging and enzymatic results are summarised at the bottom of each table. The total for ranging plus direct and enzymatic plus direct contributions, respectively, are the same as those resulting from an application of structural ranging and enzymatic analysis i.e. it may be said that entanglement analysis "explains" the structural analysis.

Share parameter entanglements - percentage point contributions

Clinton	Mean	Std Dev	Skewness	Kurtosis	Corr
Mean	19.3	-1.8	0.5	-2.0	-5.6
Std Dev	-1.8	2.6	-0.4	0.8	3.1
Skewness	0.5	-0.4	2.1	0.0	1.0
Kurtosis	-2.0	0.8	0.0	0.2	1.1
Correlation	-5.6	3.1	1.0	1.1	3.1
Ranging	-8.9	3.5	1.0	1.1	NA
Direct	19.3	2.6	2.1	0.2	3.1
Total R + D	10.4	6.1	3.1	1.3	3.1
Enzymatic	NA	-1.8	0.1	-1.2	-0.4
Direct	19.3	2.6	2.1	0.2	3.1
Total E + D	19.3	0.8	2.2	-1.0	2.7

Dole	Mean	Std Dev	Skewness	Kurtosis	Corr
Mean	-1.2	1.8	-0.5	0.4	3.3
Std Dev	1.8	-0.4	0.4	0.0	0.3
Skewness	-0.5	0.4	-1.7	0.3	-0.7
Kurtosis	0.4	0.0	0.3	-0.2	0.7
Correlation	3.3	0.3	-0.7	0.7	-3.2
Ranging	5.0	0.7	-0.4	0.7	NA
Direct	-1.2	-0.4	-1.7	-0.2	-3.2
Total R + D	3.8	0.3	-2.1	0.5	-3.2
Enzymatic	NA	1.8	-0.1	0.7	3.6
Direct	-1.2	-0.4	-1.7	-0.2	-3.2
Total E + D	-1.2	1.4	-1.8	0.5	0.4

Perot	Mean	Std Dev	Skewness	Kurtosis	Corr
Mean	-18.1	0.0	0.0	1.6	2.3
Std Dev	0.0	-2.2	0.0	-0.8	-3.4
Skewness	0.0	0.0	-0.5	-0.3	-0.2
Kurtosis	1.6	-0.8	-0.3	0.0	-1.8
Correlation	2.3	-3.4	-0.2	-1.8	0.1
Ranging	3.9	-4.2	-0.5	-1.8	NA
Direct	-18.1	-2.2	-0.5	0.0	0.1
Total R + D	-14.2	-6.4	-1.0	-1.8	0.1
Enzymatic	NA	0.0	0.0	0.5	-3.1
Direct	-18.1	-2.2	-0.5	0.0	0.1
Total E + D	-18.1	-2.2	-0.5	0.5	-3.0

To fully appreciate these results it is, of course, important to have a good understanding of the underlying distributional parameters for each option and how they relate between options. For example, knowing that Clinton has a substantially higher mean appeal, it is to be expected (as shown) that the negative correlation of appeal with other options will, through entanglement, negatively impact on share of choice. Clinton's wider than average standard deviation also negatively impacted the contribution of his general appeal to share of choice. Such information also indicates how multiple parameters need to be brought into consideration when reviewing prospects for modifying an option.

Partitioning appeal, advantage and share – Simulation analysis

Options Analysis simulated change analysis

Simulation analysis enables the "what if" capabilities of Options Analysis through the execution of appeal scenarios.

While parameter adjustment analysis is used for explanation of parameter contributions to a particular output result, simulated change analysis can show how particular parameter change inputs contribute to variations in advantage and disadvantage and share outputs. From this viewpoint, simulation provides an alternative analysis perspective for examining relationships of appeal with advantage, disadvantage and share.

In addition, simulation analysis facilitates projection and forecasting when supported by suitable monitoring or tracking data.

Assessing the global effects of simulated change

If you are interested in the possible effects of *changing* option appeal, you can change any one or more appeal parameters for one or more options to simulate the advantage, disadvantage and share consequences. The results may be compared with those for the unchanged analysis or with a range of variant changes. This is the process that underlies simulated change analysis.

Options Analysis provides two approaches:

1. Detailed control over parameter changes for up to three options to produce an output scenario. (Some re-sorting changes, such as randomisation, can be applied to all options.)

2. An alternative which allows a more limited range of parameter changes for up to three options, but which provides for the output of up to five different scenarios as a series.

These simulation methods are available through both the structural and functional analysis streams. (You can use both streams in a single computer run to double your output if you want.)

It is advisable to limit the number of changes made in any analysis run. Stepwise changes are most generally useful; change just one parameter and option at a time and note the incremental impacts. Because there will usually be entanglement effects, changing the order of changes may also be insightful.

If you wished to change multiple options and parameters beyond the limits of a single program run, this can be achieved with extra passes. Simply specify your change requirements and request case-by-case output for a "dummy" analysis (where your primary interest is in the case-by-case listing). Then select the case listing data for the scenario and use it as input for further changes to additional options or parameters.

Here is an example of simulation results for change in shares for a number of levels of skewness of Clinton appeal. The input data is the sample found in ExampleSample.XLS included in the Options Analysis download materials. Some non-linearities in the effects of the changes to skewness are evident.

Effects on share of changing Clinton appeal skewness					
Scenario	Clinton skewness	Clinton	Dole	Perot	Totals
Initial status	-0.32	58%	32%	10%	100%
Scenario 1	-0.50	63%	28%	8%	100%
Scenario 2	-0.25	56%	33%	10%	100%
Scenario 3	0.00	54%	35%	11%	100%
Scenario 4	0.25	53%	35%	11%	100%
Scenario 5	0.50	53%	35%	12%	100%

Options Analysis series simulation analysis provides an approach for systematically exploring known enzymatic and ranging effects of selectively changed parameters.

Using Options Analysis simulation for forecasting and projections

It is a relative commonplace to track and project shares of choice on the basis of trends. Political opinion poll data is one example. Both experience and options analysis theory suggests projecting such data is hazardous. No matter how apparently stable a trend in a series of share results, a dramatic change is always possible no matter what the size of the differences in option shares. Furthermore, such share data provides little or no internal information on possible turning-points.

Appeal data on each of the relevant options is both more accurate and more stable than share data. The inter-relationships amongst appeal parameters of these options will determine share levels and their changing relationships will reveal share turning points.

If you have tracking data on appeal, you can generate trend data for the distributional parameters and project these. To generate a forecast with Options Analysis simply take your latest sample data and use Options Analysis simulation to create scenarios with your projected parameters, then execute these scenarios.

You can also use trend data and projected scenarios as a tool for managing options in desirable directions through promotion of activities which are consistent with preferred parameter changes. Such data application is anticipatory and proactive (as the focus is on input management to achieve share outputs), while share output tracking is characteristically reactive and delayed.

Performing a structural or functional analysis on a simulated change scenario

As well as evaluating global effects of variant scenarios on advantage, disadvantage and share of parameter change, you can apply parameter adjustment analysis to evaluate parameter sources of advantage, disadvantage and share for scenarios. Analysis here is identical to structural and functional parameter adjustment analysis except that the input is your scenario. Obviously, the focus of such scenario analysis changes from the output effects described above to input effects as described in the sections on functional and structural analysis.

Casewise adjustment of appeal data for simulation

As elsewhere in the application of Options Analysis, the use of casewise adjusted data is recommended for simulation. Applying parameter change to unadjusted and adjusted data, respectively, will usually deliver different results and have different interpretations. The use of unadjusted data and the variable manipulation of unadjusted parameters, implies selective manipulation of both generic selection set appeal and (generic) leniency error, in addition to comparative option appeal! Not only does the use of casewise adjustment ensure that the focus is on inter-option comparison but it also simplifies interpretation of the results.

Casewise re-adjustment of appeal data for simulation

Changing appeal parameters in creating a scenario (other than changes to mean option appeal) will readjust initial casewise adjustment to eliminate extraneous variation. This does not affect the global results of simulation on advantage, disadvantage and share. It will, however, change the parameter results obtained from a parameter adjustment impact analysis on a scenario.

When performing a parameter adjustment impact analysis on a scenario you are provided with the opportunity of re-adjusting the data so that the ratings for each case have the same mean as the grand mean. This is the same process as for the original casewise adjustment.

Unless there is a good reason, the re-adjustment checkbox should be left unchecked. This simplifies analysis involving comparison of the original and scenario parameter adjustment results. The parameters can be directly compared. This becomes less practical with casewise re-adjustment as the nature of this change also needs to be taken into account in the interpretation.

The un-re-adjusted casewise results maybe interpreted as showing the immediate impact of the scenario changes. The results of a parameter adjustment analysis of a scenario based on casewise re-adjustment will better reflect the selection-set-wise perceptions after a period of adjustment. (This raises the interesting but analytically unexplored area of generalisation of option characteristics within selection sets over time.)

Parameter descriptions and applications – Levels, disparity and shapes

The following distributional measures are available for adjustment or change.

Means

The mean is the single best indicator of the general standing of an option relative to alternative options.

Parameter **adjustment** for the mean involves standardising all the option means on the grand mean as the average for all options included in the selection set.

Parameter **change** for the mean involves assigning a new mean to one or more options for the purposes of constructing a scenario to analyse the effects of the change.

Standard deviations

The standard deviation is an indicator of the disparity of the appeal ratings. A small standard deviation means that people are comparatively similar in their ratings while a large standard deviation shows high disparity.

Parameter **adjustment** for the standard deviation involves standardising to the mean standard deviation for all options included in the analysis.

Parameter **change** for the standard deviation involves assigning new standard deviations to one or more options for the purposes of constructing a scenario to analyse the effects of the change.

Skewness

Skewness indicates the degree of asymmetry in the appeal distribution. Positive skewness indicates that the majority of the appeal ratings lie below the mean. Negative skewness means the majority of the appeal ratings lie above the mean.

Parameter **adjustment** for skewness involves reducing the skewness to zero for all the options included in the analysis. This makes all the distributions symmetrical with an equal number of respondents above and below the mean.

Parameter **change** for skewness involves assigning new skewness to one or more options for the purposes of constructing a scenario to analyse the effects of the change.

Kurtosis

Kurtosis assesses the concentration of appeal scores in the middle of the distribution relative to the tails. Positive kurtosis involves a leptokurtic distribution. It indicates that many of the measurements are specially concentrated in the middle of the appeal distribution and the tails relative to in-between. Negative kurtosis is usually indicative of a flatish distribution i.e. it is platykurtic. Even more extreme is a bi-modal distribution.

Parameter **adjustment** for kurtosis involves reducing the kurtosis to zero for all the options included in the analysis. This provides for the same kurtosis as a normal distribution which is the adopted standard.

Parameter **change** for kurtosis involves assigning a new kurtosis to one or more options for the purposes of constructing a scenario to analyse the effects of the change.

Normalisation

Analysing separately for levels of skewness and kurtosis can provide both additional insights and more accuracy. But it is not always possible to obtain their satisfactory adjustment. Furthermore, their demands on computing time can be significant and may not be warranted where they are known to be of little importance.

Adjusting both skewness and kurtosis to zero yields a normal distribution of appeal ratings. An alternative method, which **can only be applied in parameter adjustment analysis**, is to normalise the data in one step. This involves ranking appeal ratings within an option and deriving adjusted appeal ratings using the NORMINV function of Excel. While this is also an iterative procedure it is much faster than for adjusting or changing skewness or kurtosis.

The procedure usually reduces skewness to low levels but can leave kurtosis quite high, although often relatively uniform. The adjusted levels for skewness and kurtosis are provided as part of the normalisation results so that the process can be evaluated.

Note on skewness and kurtosis adjustment and change:

Unlike adjusting or changing means and standard deviations, it is not always possible to achieve satisfactory adjustment or a target change for skewness and kurtosis. Difficulties are most likely to occur when the number of measurement points in the appeal distribution is small. The extremity of the adjustment or change may create added difficulty.

With the method applied in Options Analysis, when skewness is adjusted or changed kurtosis is commonly affected. This means that adjusting or changing skewness also involves readjusting kurtosis back to its prior level. The same happens with adjusting for kurtosis. In adjusting or changing either or both skewness or kurtosis, either parameter may present problems in making the adjustment or attaining the target change.

Whether it is possible to obtain a satisfactory result for both depends partly on the flexibility available to adjust the appeal distribution. So when there are limited measurement points on an appeal scale, there are limited possibilities for achieving an acceptable adjustment or change result. Casewise adjustment of input data can aid a solution by creating additional data points within each appeal distribution and, thus, adding the required flexibility.

The criterion adjustment or change stopping level is within plus or minus 0.01 of zero (for parameter adjustment) or of a stated target (for simulated change), for both skewness and kurtosis. This criterion is used to complete the iterative process but the final step is always to readjust the non-target parameter. Thus, it is possible that the final result will exceed a difference of 0.01. The achieved results are shown in the output for individual parameter adjustments so that any deviation from the target level can be readily evaluated.

Parameter descriptions and applications – Inter-correlation and inter-alignment

Introduction

Correlations between options are the result of commonly perceived concordant or contrasting appeals. This does not mean respondents need to compare options in the course of evaluation. Rather, such relationships emerge as a function of options being more of less differentially relevant amongst respondents in shared respects, regardless of the level, spread or shape of their appeals.

For the analysis of means and standard deviations, only one analysis method is provided. For adjusting skewness and kurtosis, there are two methods. For adjustment or change of correlated inter-relationships between options, there are a range of procedures including randomisation, concordant and contrasting sorts of appeal ratings.

Procedures involving re-sorting of appeal ratings require some change in analytical perspective. They do not change distributional variance but change covariance through well-defined manipulation of inter-option relationships. For this reason they are particularly useful for assessing inter-correlational impacts on share of choice.

By contrast, inter-alignment adjustment is analogous to adjustment of means, standard deviations, etc., in directly accounting for appeal variation. It can provide precise data on **direct** correlation impacts on share, but only in certain well defined circumstances.

Inter-alignment is only applied in parameter adjustment while randomisation is used for both parameter adjustment and simulation analysis. The remaining methods that involve re-sorting of ratings, are only available for simulation.

Analysis of inter-option correlations and casewise adjustment of input data

A general recommendation is that input data be adjusted casewise to remove variation extraneous to analysis of preference and choice amongst options. However, a result of this process is that each option becomes a linear function of the remaining options. This is a statistical artefact of adjusting all rating means for cases to equal the appeal grand mean. Application of common methods for inter-correlational analysis amongst the options (e.g. regression analysis) will invariably provide misleadingly perfect predictions. This data is misleading because it is composed **jointly** of systematic **and** (random) idiosyncratic appeal variation.

The correlational effect of casewise adjustment is most clearly illustrated for two options. Here, the correlation between adjusted options will always equal −1.0 (except for perfectly positively correlated unadjusted options). As the number of options included in an analysis increase, so the underlying systematic associations have increasing degrees of freedom to assert their presence and character. However, such inter-option correlations should be regarded cautiously, and treated as indicative.

Of course, the interpretation of the correlations amongst unadjusted options can proceed normally. However, unadjusted data contains associations based on generic selection set motivational levels and leniency rating errors in addition to inter-option concordance and contrast. Only inter-option concordance and contrast have a role in inter-option selection, but motivational and leniency factors can dominate or obscure them if not removed.

Nature of inter-alignment

Inter-alignment simply refers to the variation of individual appeal ratings about the grand mean for all ratings.

The specific meaning of inter-alignment in any particular adjustment analysis varies according to its context and use. Inter-alignment accounts for **all** appeal associated with unanalysed parameters, **plus** idiosyncrasy. If adjustment is made only for inter-alignment, it will account for **all** variation in appeal amongst the options. (Of course, there will still remain any share effects associated with blockage.)

Inter-alignment adjustment is included in structural analysis. When applied, it is always the last adjustment to be executed in the stepwise structural analysis process (whether ranging or enzymatic).

Inter-alignment and idiosyncratic variation

Idiosyncratic variation, which is always included in inter-alignment, refers to the "unique" sources of appeal that are unshared between individuals. This idiosyncratic variation, from a group perspective, is characterised by randomness. Idiosyncratic variation is the residual appeal after accounting for differences in option means, standard deviations, skewness, kurtosis plus inter-option correlation.

If idiosyncratic variation accounts for a substantial part of the total inter-alignment, patterns of correlation may be difficult to discern in scattergrams, even after all other sources of variation in appeal have been eliminated.

Inter-alignment and correlation effects

After appeal variation associated with means, standard deviations, skewness and kurtosis has been removed, appeal inter-alignment accounts jointly for correlation and idiosyncratic variation. Since idiosyncratic variation is random, controlling for inter-alignment will show the change in share attributable solely to *direct* correlational effects.

This procedure cannot account for the *indirect* or *total* effects of correlation on share. Nor can it separate the correlational and idiosyncratic components of appeal to account for their independent effects on advantage and disadvantage.

Parameter descriptions and applications – Inter-correlation and randomisation

Randomisation adjustment in functional and structural analysis

Randomisation provides a general-purpose approach for analysis of the inter-option correlation. Depending on the context and placement of its application, it is able provide an estimate of the total, direct or indirect correlation effects on shares and associated co-variation impacts on advantage and disadvantage.

If randomisation is analysed alone or precedes all other adjustments, it will account for total correlation effects on share and covariance effects on advantage and disadvantage (within the limits of sampling variability). If it follows all other adjustments (except inter-alignment) it will account for direct effects of correlation on share and co-variation on advantage and disadvantage. The differences between these results are the indirect or entanglement effects for advantage, disadvantage and share, respectively.

Combining randomisation and inter-alignment adjustment analysis

Within structural analysis, randomisation adjustment can be requested alone or along with inter-alignment. Where both are requested, randomisation will always be executed before inter-alignment. Inter-alignment analysis will be based, as usual, on the residuals of the preceding analysis.

The details of each analysis will be included. However, for the analysis summary the results of both are usually combined to show the global effects of correlation and idiosyncrasy. This combining provides a more accurate result for the correlation effects on share.

Considerations in applying randomisation

In applying randomisation the following considerations are relevant.

Metric assumptions: Options Analysis of appeal involves interval scaling assumptions for **each** individual's ratings. Often, it is unnecessary to assume that unit distances are the same **between** respondents.

However, with randomisation (and all other re-sorting procedures) one of two positions may adopted:

1. The option data distributions are samples from parent distributions and that any random sorting will produce a more-or-less representative distribution of randomised inter-option differences regardless of inter-individual differences in the interval scales applied.

2. Or, that swapping of ratings between cases through sorting or randomising to alter inter-correlation requires the assumption that appeal for all respondents is measured on an individually comparable interval scale i.e. raters share a common conception of distances along the appeal scale.

The first assumption allows one to proceed as in the same manner as for other parameter adjustments or change. The second assumption is more likely to be reasonable where sources of differentially extraneous influence are removed. This is another reason for applying casewise adjustment to the input data.

Sampling variation: Randomisation is akin to a sampling procedure and will yield results which will fluctuate from run to run within usual limits for any given sample size. Multiple runs may be needed to confirm what is to be typically expected, especially with smaller samples. (Unlike randomisation, ascending and descending sorts of appeal ratings will yield invariant results, as will all the other methods for parameter adjustment.)

Criteria for randomisation: A criterion of randomisation short of zero correlation with other options is usually applied. The default is a correlation level of less than ±0.1. This will usually give satisfactory results but can be altered if desired on one of the dialogs where the request for the randomisation is checked. The range of the criterion provides another source of variability of results from run to run.

Increased difficulties in reaching a given criterion will occur with small samples or a large number of options or a combination of both.

Accounting for variation: As with all re-ordering procedures, randomisation adjustment does not adjust the size of any ratings. This means that randomisation does not account for the variation of ratings but only for the covariance between options. It is this adjustment which is to be found in the changes to advantage and disadvantage. (Meanwhile, randomisation will **fully** account for its effects on shares of choice.)

Blockage impacts: Randomisation will tend to disconnect blockage for cases having blockage on two, more, and all options. For example, cases unaware of all options in an analysis will most likely be re-sorted so that unawareness is matched to rated options. Here, the result will be that total unawareness disappears from the results. Most particularly, such changes are likely to affect the share of choice results for both the randomisation adjustment and any other adjustments that follow.

Some thought should be given to at least filtering cases with blockage on all options before using randomisation in an analysis. Consideration might also be given to filtering other cases with blockage but the action taken will vary according to the situation.

Blockage may also impact on results with other methods involving re-sorting of option ratings but the impact is likely to be lower. For ordered sorts, blockage is sorted to the lowest level.

To see how blockage has been handled for any analysis you can request a listing of the case-by-case results.

Parameter descriptions and applications – Inter-correlation and simulation

Simulation

The use of procedures involving the re-sorting of ratings between cases, such as randomisation, is more straightforward when applied to simulation of global impacts as the effects can be evaluated in a manner identical to changes to means, standard deviations, and so on.

Changing inter-correlation for one or a few options for simulation

When changing the option interrelationships of a target option there are two methods that systematically change all inter-relationships in ways that can be readily understood:

- **Fully randomising an option:** Here, correlation with all other options is eliminated.

- **Reverse sorting an option's appeal:** This is approximately equivalent to reversing the sign of an option's current relationship with all other options. (The case-by-case output should be checked as the result can be affected by the grouping of blocked cases.) Reversing more than one option means the reversal is "un-reversed" in relation to already reversed options.

Randomisation and reversal of a specific option is likely to be enlightening. By running an option on these variations plus its unchanged state it should be possible to plot and perhaps interpolate the impact of correlation changes. (Linear trends should not be assumed.)

For more information on these change methods refer to "Functional analysis – simulated parameter change – correlations", or, to "Structural analysis – simulated parameter change – correlations"

Changing inter-correlations amongst all options for simulation

Methods are available for evaluating change amongst *all* options in a selection set. These include:

- **Positive alignment of all appeal ratings on all options.**

- **Randomisation of all options.**

For more information on these change methods refer to "Functional analysis – simulated parameter change – correlations", or, to "Structural analysis – simulated parameter change – correlations".

A third approach, that may be used to obtain a **"high contrast" scenario**, involves allocation of all options to one of three categories: positively aligned, negatively aligned (i.e. opposite to positive), and randomised. For this last method refer to "Functional analysis – simulated parameter change – mixed correlations", or, "Structural analysis – simulated parameter change – mixed correlations".

Parameter adjustments and changes – Other technical matters

Rounding of advantage data to infer choice or preference

For inferring choice or preference, functionally equivalent but numerically different appeal measures should be made the same. Differences between options that are tiny fractions of an appeal unit, for example, have no substantive meaning and need to be equated.

To obtain functionally equivalent ratings while avoiding the merging of potentially distinct ratings, all advantage and disadvantage ratings are rounded to the nearest 100th of the appeal scale range by default. (Note that "rounding" here refers to the nearest n^{th} point of the scale range – not the nearest whole number.)

An appropriate appeal scale range will usually be that used to collect the data e.g. for a thermometer scale the number to enter into the initial dialog editbox for "Range of Scale" would be 100. An alternative value could be the range of the ratings to be analysed. A rounded approximation will usually be satisfactory. The same scale range value should be used in **all** analyses involving the current study scale data, even though the actual data range will vary somewhat from one sub-analysis to another.

You can test the sensitivity of your results to a change in this rounding criterion. Simply insert your preferred multiple or fraction of the scale range into the dialog editbox and re-run your analysis. Doubling your entry for "scale range" will result in rounding to one 50th, and quadrupling will round to one 25th of the range. An immediate effect, if any, of reducing scale sensitivity will be to the share results for tied ratings i.e. the coarser the scale the more the ties.

Options Analysis of share and the effects of tied ratings

Options Analysis procedures infer choice based on highest option appeal. An option with superior appeal is assigned a choice probability of one while options with tied highest appeal are assigned a choice probability equal to one divided by the number of equal ratings. These probabilities are summed to obtain option share estimates.

In performing Options Analysis parameter adjustment or change analysis, tied highest ratings are the first to affect share results. This is because differences in option appeal ratings are smallest for ties. For example, In hierarchical parameter analysis tied ratings can move as a block to a choice for one option, then as a block to another option, or revert to tied ratings, and so on for each parameter adjustment or change. Since tied ratings may make up a significant proportion of the data it may be important to be aware of the consequences. Coarse rating scales will exacerbate the effects. Factors affecting the impact of tied ratings on share results include: the prevalence of tied ratings in the input data; their pattern of allocation across the options; the number of options in the selection set; the type of parameter being adjusted or changed; and the nature of any preceding parameter adjustment or change.

Where ties are of special interest the data should be examined. When only two options are being analysed ties can be filtered out and the results, with and without filtering, compared. Otherwise, request casewise output data when performing the analysis then copy the advantage and choice casewise data to the appeal sheet. Sort for zero advantage for each option in the unadjusted column to reveal the patterns of effect for changes and adjustments.

Weighted sample data

Options Analysis does not incorporate facilities for fractional sample weighting. If you have a weighted sample and believe that the weighted and un-weighted results may be substantially different, then you can create an integer-weighted sample to create weighted results.

The Options Analysis download package includes an Excel macro procedure with instructions for the creation of an integer-weighted sample using your weight data, Or, you may have an analysis package capable of exporting an integer-weighted sample which can be used in Options Analysis.

An integer-weighted sample is likely to be much larger than the original sample, undermining the application of the statistical tests. Such a sample will artificially yield higher levels of statistical significance. The larger sample will also mean longer analysis run-times.

Using Options Analysis - Data input

Entering appeal data for options

Options Analysis handles up to 30 options within a single selection set analysis.

Up to four types of data can be included in the option appeal range:

1. Option labels (if present are always in the top row).

2. Appeal ratings (always numeric).

3. Missing values code (if present, can be alphanumeric).

4. Blockage code (if present, can be alphanumeric).

If other non-numeric codes or blank cells are included, an error message will be displayed stating that if you proceed, cases with these codes or any blank cells will be excluded from the analysis.

In executing an analysis, only the data within this appeal range is validated.

General data selection and entry

Other input data can also be added and associated with the option appeal data. The purpose of this supplementary input is simply to facilitate any later analysis or filtering you may wish to perform on the option appeal data. For example, if you wished to analyse appeal differences between males and females, you would filter on a sex variable contained in the supplementary data.

Both the option appeal and the other input data should be set out with variables in columns and cases in rows. The appeal ratings should be in one contiguous area and other input data in another single block. They may be on the same or different spreadsheets. The number of cases in each block should be the same. To enable filtering, the case for each row of appeal data should be the same case for the corresponding row of supplementary data.

Altogether, appeal ratings plus other data variables can occupy up to 250 columns for any analysis.

The number of cases can be as large as the total rows in your spreadsheet minus 20.

Options Analysis inputs for analysis only the data you have selected that is not hidden. To make separated options contiguous you can use Excel to hide any columns and rows you don't want to include as well as any blank columns. In this way, or by using the Excel filter functions, you can select cases or options to analyse sub-samples or sub-sets of options without moving or copying your data.

Using Options Analysis - Specifying your analysis requirements

Setting up your requests

After pulling down the Tools menu and selecting the Options Analysis menu item, you will step through a series of dialogs to specify your data, its analysis, and your supplementary output requirements.

Multiple analyses can be requested in a single program run. Mostly, you will probably find doing one analysis at a time to be preferable.

The basic data entry dialog comes up when you start the program. Here you specify your input data and how you want it processed and adjusted before it is analysed.

You also select one or more general analysis streams:

1. Fundamentals analysis.

2. Option impacts analysis.

3. Structural analysis.

4. Functional analysis.

You will automatically progress through the relevant structural and functional analysis dialogs depending on your selections.

Completing the dialog sheets

On each dialog enter your requirements moving from item-to-item using your mouse or the TAB key.

Only use the ENTER key for exiting each dialog. (The default is usually to proceed to the next dialog.)

If you have not supplied the information needed to move to the next dialog you will be prompted to supply it.

If you need help then click the HELP button.

If you wish to leave Options Analysis press CANCEL. (Many settings are preserved between runs within a session.)

If you need to move back a step press the BACK STEP button. Your request for the current analysis will be turned off, and you will be taken back to the preceding step for the analysis in your current dialog. This will not necessarily be the dialog you last saw. (If you want to go back to that particular dialog, wait till you get to the Analysis Summary dialog when you can choose to return to any Options Analysis procedure.)

Reviewing your requests

Whatever your path you will finish at the Analysis Summary dialog where you are able to review your requests.

In the Analysis Summary dialog you can:

1. Switch off any requests you have made.

2. Switch on any analysis options you would now like to do.

3. Switch to analysis options you have requested but wish to check or adjust your specifications.

4. Switch back to check your data entry configuration.

You can also usually request:

1. Basic statistics summarising the results for appeal, advantage and choice.

2. Case-by-case output data on advantage, disadvantage and choice, for further analysis.

In addition, you can also request a copy of the raw unadjusted input data be added to the results workbook. (A copy of the processed and adjusted input data is always added to the output workbook.)

Using Options Analysis - Analysis options

Fundamentals analysis

Provides data validation and core statistics on appeal, advantage, disadvantage and share.

You may request an analysis of:

- casewise unadjusted data, or

- both the casewise unadjusted and adjusted data (the default).

Commonly, it will be useful to perform fundamentals analysis for any new set or combination of options or cases.

Option impacts analysis

Shows the relative frequency with which each option draws its preferences from each of the other options. It allows an assessment of the competitive structure amongst the alternatives in terms of comparative preferences.

Structural parameter analysis

Provides an analysis of a set of option appeal distributions adjusted hierarchically for each selected parameter, to show the step-by-step makeup of each option's share, advantage, and disadvantage within the selection set. You may opt to do:

- a ranging (or forward) analysis from means to correlations, for example, or

- an enzymatic (or backwards) analysis from correlations to means, for example.

Structural analysis of simulated change

Gives results for share, advantage, and disadvantage for any appeal parameter scenario you create for a set of options. You may select:

- a global effects analysis, or

- a structural parameter analysis of the scenario.

Global analysis will provide a before and after comparison of advantage, disadvantage and share. A structural parameter analysis will show your selected ranging or enzymatic step-by-step analysis of appeal parameter contributions to the scenario.

Structural series analysis of simulated changes

Provides global results on share, advantage, and disadvantage for a set of options. Results are provided for the unchanged status plus up to five scenarios that you create by selecting and setting appeal parameters.

Functional parameter analysis

Provides the total effects of adjusting one or more selected parameters on share, advantage, and disadvantage within a set of options. You may select to perform:

- a separate adjustment analysis for each parameter selected, or,

- a single combined analysis for a selected group of parameter adjustments.

Functional analysis of simulated change

Gives results for share, advantage, and disadvantage for any appeal parameter scenario you create for a set of options. You may select:

- a global effects analysis, or

- a functional parameter analysis of the scenario.

Global effects analysis will provide a before and after comparison of advantage, disadvantage and share. A functional parameter analysis will show your selected separate or combined parameter analysis contributions to the scenario.

Functional series analysis of simulated changes

Provides global results on share, advantage, and disadvantage for a set of options. Results are provided for the "base state" plus up to five scenarios that you create by selecting and setting appeal parameters.

Note: Performing any simulation analysis to obtain global changes in advantage, disadvantage and share will provide the same results regardless of whether requested in the functional or structural analysis dialog stream. As global simulations are available in both streams, multiple requests can be executed in any one Options Analysis run.

Using Options Analysis - Analysis output

A results workbook for each run

Each run of the Options Analysis program automatically generates a new Excel workbook for your results.

A summary sheet for each analysis request

Within a run, for each analysis option you have selected, a sheet containing a summary of the results will be found in the workbook. Each sheet includes documentation of key elements of your analysis specification.

Supplementary data sheets

In the Analysis Summary dialog sheet, where you confirm your final selections for analysis, you can request additional data by checking the box under "Analysis Data" for each specific analysis procedure. Using checkboxes at the bottom of this same dialog you can qualify your selection by choosing whether you would like to have:

1. statistics for appeal, advantage, and share,

2. case-by-case listing of results for appeal, advantage and share, or

3. both combined.

The data output sheets for each analysis immediately follow the relevant summary analysis sheet.

Commonly, there will be three sheets for case listing output - one each for appeal, advantage, and choice data. The first part of the sheet names will show the analysis to which they belong. The data sheet suffixes are "AppDat", "AdvDat" and "ChiDat", respectively.

For some analyses the data will be on a single sheet with the suffix "Dat".

If you select to output only summary statistics, the supplementary output sheet will usually have the suffix of "DataStats".

The headings in these casewise output sheets indicate the state of the data *after* the indicated adjustment has been made i.e. the data is for the adjusted status. For example, the data under a heading "Means adjustment" shows the casewise output for options standardised to the grand mean.

Alternative appeal data and option consolidation

An additional special set of columns will be found in the FundamentalsDat data sheet produced via a fundamentals analysis. These columns are headed "Alternative appeal data". Each column contains the highest appeal amongst options other than option at the head of the column. Each column is a surrogate variable for all the *other* options included in the analysis.

This can be used to reduce the number of options in further analysis to two – the option of interest and the "ALT" option. Or it can be used with a sub-set of options you want to reduce to a single option (of, say, minor substantive interest) plus another option to create the "ALT dummy", so that these "others" can be subsequently dealt with collectively, within a larger set of options. To generate these ALT options for these purposes you should *use validated data without casewise adjustment*. You can apply casewise adjustment when using the data in further analysis.

This is not a recommended approach. Consolidation should be limited to minor options and only to an extent sufficient to make analysis tractable. However, when the options in a selection set exceed the maximum able to be accommodated in a single analysis, consolidation can allow a full analysis to proceed. Care should be taken in the interpretation of output since consolidation can involve options with varying and even contradictory appeals. Comparison of analysis results between reduced and unreduced sets of options is not advisable.

Processed and raw input data

Automatically produced in every workbook is a sheet containing the validated and processed input data. It is called "ProInputData". Both the processed appeal data and any other input data, in addition to your appeal variables, will be found here.

If casewise adjustment has been requested then the processed appeal data will be adjusted data.

At the top of the very last two columns of this sheet will be found documentation on the input data details - date, time, source, data codes and treatment, and number of options and cases.

If the data have undergone casewise adjustment, the 4th to last column lists the coefficients which would need to be added to any option's appeal data to transform it to an unadjusted state. This may be useful for further analysis of adjusted or simulated results in another selection set starting with unadjusted data.

You may also request a copy of the raw unvalidated input data. It will be in a sheet named "InputCopy" including both the raw appeal input data and any supplementary input.

Using Options Analysis – Program execution

Options Analysis involves data intensive processing

Options Analysis involves extensive numerical processing. A quick response is not usually to be expected and will vary considerably according to the procedures selected, and, of course, the user's machine. Fundamentals analysis and global simulation are among the quicker procedures.

To avoid delays, Options Analysis processes in the background enabling you to continue to use the computer for other functions.

Background processing

When you have selected and specified your Options Analysis requests you will be asked to confirm your decisions.

On confirmation, Excel will be minimised and you can use your computer for other tasks while Options Analysis is running.

When execution is completed Options Analysis will beep and restore its window.

Should there be problems, such as invalid input data, the Excel icon on the task bar will flash on and off. Just click the icon to reveal the message and make any needed decisions.

If you wish to interrupt or terminate Options Analysis execution, click on the Excel icon and press the ESC or CTRL-BREAK button. Use of this feature is recommended only for termination.

How to speed up turnaround

Here are some suggestions to increase run-speed:

1. Reduce the sample size if you have a large sample. For exploratory analysis and simulation you may be better off with a random sub-sample of your total sample. Run your confirming analyses on the primary sample later. (However, do fundamentals analysis using the full sample to provide solid reference data.)

2. Reduce the number of options included in an analysis. Options of little interest or with few ratings may be excluded or included in "Other options". (See "Using Options Analysis - analysis output" for information on reducing the number of options in discussion of "Alternative appeal data".)

3. Don't ask for statistical tests if you don't need them (although Chi square tests are OK).

4. If using randomisation, keep your criterion for randomness as loose as possible – looser is faster. The default correlation maximum of ±0.1 (or 1% common variance) will be good enough for most purposes. Clearly, randomisation depends on chance and it is possible for run times to be very greatly extended, especially when the number of options is large. Also, for some very small samples it may not be possible to randomise to the desired level.

5. Skewness and kurtosis involve substantial iteration so if they are marginal to your research consider dropping them or substituting the less satisfactory but faster normalisation option.

6. Run one analysis at a time. Not only do you get a result faster but also you can use the results of each step to inform the next.

Requesting supplementary statistical data and case-by-case data output does **not** add to processing time.

Stopping or interrupting execution

It is recommended that you use this feature **only to terminate** program execution.

When you interrupt Options Analysis with ESC or CTRL-BREAK you can decide whether you want to exit or continue.

Interruption and exit are reliable but continuation or correct execution of the current analysis is not assured. A single interruption may be OK. Multiple interruptions may lead to failure.

Even with apparently satisfactory continuation, the interrupted analysis (shown on the Excel status bar at the time) should be examined for correctness when finished. Look at both its analysis summary and any associated data sheets.

Analyses completed before any escape will be found in the output workbook and will be satisfactory. Results from the particular analysis interrupted will usually be incomplete and should be discarded.

Modular production

The results of each analysis are produced modularly. You will see what Options Analysis is up to from the Excel status bar at the bottom of the screen when you stop processing. Each analysis request is added progressively to the new workbook and will be available to you even if you interrupt an incomplete Options Analysis run.

The order of execution is:

1. Fundamentals analysis

2. Option impacts analysis

3. Functional parameter analysis

4. Structural parameter analysis

5. Functional change analysis

6. Structural change analysis

7. Functional series change analysis

8. Structural series change analysis

Context sensitive help for Options Analysis

The next 23 pages include the context-sensitive help for Options Analysis when OptionsAnalysisHelp.hlp has been installed.

Options Analysis help for any current dialog sheet is invoked by clicking the "Help" button. on any dialog sheet when Options Analysis is running in Excel. (The dialog query button – next to the close button – is not enabled.)

Data specification and analysis basics dialog

Dialog summary

This dialog is for specifying input data, data validation and adjustment in preparation for Options Analysis.

The selections made here will be documented in the last two columns of the ProInputData sheet and in the fundamentals analysis summary sheet (when required).

A copy of the validated and adjusted input data will be found in the ProInputData sheet in the new output workbook.

Further user specification of structural and functional analysis is automatically enabled following completion of this dialog.

Appeals input range

Input data is selected from an Excel workbook you have opened before commencing Options Analysis.

Select or type the reference for the range of appeal data, including any labels. Data should consist of options with appeal data set out in columns. (With large files a simple method is to select the first cell, press F8, then scroll or page to the last cell then click it.)

If there are option labels these should be in the first row. Every option label should be unique.

Only visible columns and rows are included in the analysis. Hide any blank columns or options you don't want analysed. You can hide or filter any unwanted cases. Start your selection in a visible column and row.

A minimum of two and a maximum of 30 options can be selected for an analysis.

Other data input range *(optional)*

These variables are included to allow filtering of input and analysis of Options Analysis output. Even the options appeal range can be reselected as "other" variables to allow analysis by unadjusted data, for example.

Other input data is selected from an Excel workbook you have opened before commencing Options Analysis.

Cases in the range for "other data" should be the same as the cases in the appeals range. The number of rows selected must be the same.

Select the range, including any labels.

If there are labels these should be in the first row you select.

Only visible columns and rows will be included. Hide any columns or rows you don't want included. Start your selection in a visible column and row.

A maximum of 250 option appeal and "other" variables can be selected for an analysis.

This "other input" data is not validated or adjusted. Blank columns can be included. The absence or duplication of labels does not matter when a row for labels is included.

Labels in first rows

Check the check box if labels are included. Uncheck if not.

This check box applies to both appeal variables and the other data variables, if any.

If unchecked, default labels will be inserted for both appeal and other variables.

Range of scale

Enter a number for the range of the appeal scale. A rounded approximation will be satisfactory. Use the same range for all your analysis using the same scale. This information is used for rounding advantage and disadvantage data to avoid immaterial differences between options when inferring choice.

Blockage code

Include the code, which may be a word, letter or number, which represents answers of blockage such as unawareness of options. (Other reasons for not including an option appeal rating, such as unavailability or inaccessibility, can be treated in an identical manner.) The code is not case sensitive. The code is translated to an "X" in the processed data. You can leave blank if there is no blockage code.

Missing value code

Include the code, which may be a word, letter or number, which represents missing data. The code is not case sensitive. You can leave blank if there is no missing value code.

Treatment of missing values

With row elimination the full record of the respondent is excluded from analysis. Significant numbers of missing values may undermine the quality of results.

Casewise adjustment

All analysis involving parameter adjustment or change should be based on casewise adjusted data. Otherwise the results may be misleading. Generic selection set differences in motivations and rating styles are removed by this process.

Selecting casewise adjustment means every case is adjusted to have the same global mean appeal for the set of options rated. Appeal distances between options for each case are unadjusted by this process. The mean rating for each option for the whole sample also remains the same. Choices and option shares are also unaffected.

When both casewise adjustment and fundamentals analysis are selected, extended results covering both unadjusted and adjusted data will be produced in the fundamentals analysis output to enable comparison.

Analysis type

Select one or more of the analysis checkboxes depending on your requirements.

A. Fundamentals Analysis produces basic statistical description of the data and should be used for:

1. initial evaluation,

2. when casewise adjustment of the data is requested,

3. any new selection set or combination of options, or

4. when cases have been filtered.

B. Option Impacts Analysis shows the impacts of each option on the remaining options in a selection set in terms of share, advantage and disadvantage. Three or more options are required for this analysis.

C. Structural parameter analysis provides for the following types of analysis:

1. Hierarchical parameter adjustment analysis of the input data or a new scenario via:

> a) Ranging parameter analysis (e.g. from means through spreads and shapes to randomisation).

> b) Enzymatic parameter analysis (e.g. from randomisation through shapes and spreads to means.)

2. Simulation of the effects on advantage, disadvantage and share of a scenario changes via:

    a) Detailed analyses of a single scenario.

    b) Through a series of scenarios.

D. Functional parameter analysis provides for the following types of analysis:

1. Total parameter effects adjustment analysis of the input data or a new scenario via:

    a) Analysis of the separate effects of single parameters.

    b) Analysis of the combined effects of a group of parameters.

2. Simulation of the effects on advantage, disadvantage and share of a scenario changes via:

    a) Detailed analyses of a single scenario.

    b) Through a series of scenarios.

Structural analysis – Basic dialog

Dialog summary

This dialog covers selection of the type of structural analysis to be performed plus statistical tests.

Where a selected method involves parameter adjustment, the specific parameters to be adjusted are also selected in this dialog.

Where a selected method involves parameter change (i.e. simulation), the desired changes will be specified in a following dialog.

As far as they apply, the selections you make here will be used throughout Options Analysis structural analyses.

Parameter analysis

Check this checkbox to perform a structural analysis of parameters. Structural analysis of parameters aims to reveal the cumulative contribution of the selected parameters to each option's share, advantage and disadvantage as the parameters are standardised.

You will also need to check your selection of parameter adjustments and statistical tests.

Change analysis

Check the "Change analysis" checkbox and one of the two associated optionbuttons:

1. **Global impact analysis** to perform a single scenario simulation. Global impact analysis will evaluate the impacts of change of a new scenario on advantage, disadvantage and share.

2. **Parameter impact analysis** to perform a scenario evaluation. This analysis will evaluate, for your new scenario, the role of selected parameters affecting advantage, disadvantage and share.

For a global impact analysis, the parameter adjustment section is ignored, but consider the statistical tests.

For a parameter impact analysis, select parameter adjustments (that will be executed after your changes have been made) and statistical tests.

The parameter changes you wish to make will be able to be specified in a following dialog.

Series change analysis

Check this checkbox to perform a series of global impact analyses for a list of scenarios.

For this, the parameter adjustment section is ignored, but consider the statistical tests.

The parameter changes you wish to make will be able to be specified in a following dialog.

Note: Simulation using global impact analysis or series change analysis will yield identical results in both structural and functional approaches and may both be applied in a single run to produce more scenarios.

Parameter adjustments – parameters

Structural adjustment analysis is a hierarchical or stepwise analysis of option appeals effects on advantage, disadvantage and share. Parameter adjustments that can be selected are:

1. Means
2. Standard deviations
3. Skewness
4. Kurtosis
5. Normalisation (as an alternative for skewness and kurtosis)
6. Inter-alignment (for correlation and idiosyncrasy alone when all other parameters are selected)

Note on changes to skewness and kurtosis: Where skewness or kurtosis changes cannot be achieved a message will be displayed indicating the problem. After clicking on the message button,

the Options Analysis run will terminate so you can amend your request.

Parameter analysis adjustment methods

Select type of hierarchical analysis:

1. Ranging analysis – stepwise forwards.

2, Enzymatic analysis – stepwise backwards. (If inter-alignment is selected, analysis will commence with randomisation to account for correlation effects and end with idiosyncrasy analysis after adjustment for any other parameters.)

Ranging analysis and randomisation adjustment:

1. If randomisation is unchecked and inter-alignment is checked, then inter-alignment will include correlation effects.

2. If randomisation and inter-alignment are checked, summary results will be consolidated but detailed results will be provided for each.

3. If randomisation is checked and inter-alignment unchecked, only randomisation results will be included.

Note that *all* unaccounted advantage, disadvantage and share associated with variations in appeal are accounted for by inter-alignment (i.e. in addition to any associated with option inter-correlations and idiosyncrasy).

Enzymatic analysis and randomisation adjustment:

1. If inter-alignment is checked, then randomisation will be automatically performed. Summary results will be consolidated but detailed results will be provided for each.

2. If randomisation is checked and inter-alignment unchecked, only randomisation results will be included.

Note that *all* unaccounted advantage, disadvantage and share associated with variations in appeal are accounted for by inter-alignment (i.e. in addition to any associated with option inter-correlations and idiosyncrasy).

Statistical tests

Not all the statistical tests apply to each type of structural analysis. Checking the "All" checkbox will ensure that all the tests available for each type of structural analysis are executed.

Structural analysis – Simulated change dialog

Dialog summary

On this dialog:

1. Consider whether you want to copy or reset the scenario details.

2. Enter any options and associated parameters you wish to change for this scenario.

3. Consider whether you wish to change inter-option correlations for the scenario.

Analysis type

The analysis option you have selected is either:

1. Global impact analysis, or

2. Parameter impact analysis.

Global impact analysis provides impacts of your scenario changes on advantage, disadvantage and share. Global analysis results compare the original appeal impacts with the scenario impacts.

Parameter impact analysis performs a structural adjustment parameter analysis on the new scenario created by the changes you make using this dialog.

Casewise re-adjustment: Unless there is a good reason, this checkbox should be left unchecked. Leaving it unchecked simplifies comparison between changed and unchanged parameter adjustment results. (Scenario changes partly modify the original casewise adjustment. This can affect parameter impact analysis. Casewise re-adjustment can be performed by checking the re-adjustment check box.)

Set-up for parameter changes

Before entering any of your own changes you may:

1. copy the "Functional Change Settings" or

2. reset the current settings to clear current entries.

3. You can then make your own changes. (This is the default option.)

Note on copying "Functional Change Settings": This copying affects both the scenario settings on the current dialog and the settings for inter-correlation on the following dialogs for the present analysis. If the "Change Inter-Option Correlations" checkbox is unchecked, no inter-correlation changes will be made.

Selecting options and making parameter changes

You may:

1. change the means, standard deviations, skewness or kurtosis for up to three different options, or,

2. check the "Change Inter-Option Correlations" checkbox, or

3. do both.

Note on changes to skewness and kurtosis: Where skewness or kurtosis changes cannot be achieved a message will be displayed indicating the problem. After clicking on the message button, the Options Analysis run will terminate so you can amend your request.

Parameter change table

First select one to three different options using the drop-down boxes for "Options to be changed".

Then you can insert any changed parameters for the scenario. A "changed parameter" is a new parameter value - not just the amount of change. For example, the current mean for Option 2 may be 10 and for your new scenario mean you may want 30. Enter 30.

Blank cells and cells not enabled will be treated as "no change".

Note on enabled settings: Only changed parameter settings, which have an option name at the top of the column, will be included in the analysis. Other entries are not enabled and are ignored for execution.

Change inter-option correlations

If this box is checked you will be automatically taken to the inter-option correlations change dialog when you leave this dialog.

Structural analysis – Simulated change – Correlations dialog

Dialog summary

On this dialog you can select one of five different methods for changing the interrelations between options. Selection of an option will enable any sub-settings.

By constructing a series of well-understood relationships between options, a picture can be built of the character and significance of inter-option correlations for share, advantage, and disadvantage.

Note: All of the methods here involve re-sorting or randomising of option data between at least some cases on some options. Consequently, output of casewise results reflecting such change will not usually relate case-by-case to input data listings on the ProInputData sheet.

Set all options to full positive alignment

All the option appeal ratings are sorted in ascending order. A high level of positive inter-correlation will be achieved.

Blocked cases are sorted to the lowest level. (This type of change can also have a significant impact on share, advantage, and disadvantage.)

If there is little difference between the appeals of the options in the analysis the share results can be very unstable and potentially misleading. Closely examine the levels of advantage in the results.

Randomise all options

All cases for every option are randomised. (The order of the first option is left unchanged.)

The objective here is to reduce the levels of inter-correlation between all options to close to zero.

Selecting this optionbutton will enable its "Maximum deviation from zero for any r" editbox. The default level is ±0.1 (or 1% common variance). This sets the maximum product-moment correlation between any two options. Reducing this criterion further can substantially extend execution time, especially as the number of options increase. If any attempt between any two options takes 250 iterations you will be notified of the problem of achieving your criterion and the program terminated so you can alter the default correlation level.

Randomise selected option ratings

All cases for the selected options are randomised. The objective here is to reduce the levels of inter-correlation between each selected option and others to close to zero.

Selecting this optionbutton will enable its "Maximum deviation from zero for any r" editbox. The default level is ±0.1 (or 1% common variance). This sets the maximum product-moment correlation between any two options. Reducing this criterion further can substantially extend execution time, especially as the number of options increase. If any attempt between any two options takes 250 iterations you will be notified of the problem of achieving your criterion and the program terminated so you can alter the default correlation level.

Select from one to three options from dropdown boxes.

Reverse alignment for selected options

Selecting this optionbutton will enable the dropdown boxes from which you can select up to three options.

Reverse alignment involves a reverse sort of a sorted option. Its approximate effect is to change the sign of its correlation with other un-reversed options.

Together with selective randomisation and its original alignment result, it may be used to define systematic effects on share, advantage and disadvantage of changes in inter-option correlation.

Blocked cases for the selected options are sorted to the lowest level. (This change may have a significant impact on share, advantage, and disadvantage.)

Mix different changed inter-alignments

If selected, specifications for this procedure are in the following dialog where all options will be set to fully positive, fully negative, or random in their relations to all other options.

Note on randomisation: All cases in an option selected for randomisation are randomised regardless of whether they have an appeal rating or are blocked.

Note on enabled settings: Only the settings you have currently selected in the dialog are enabled for program execution.

Structural analysis – Simulated change – Mixed correlations dialog

Dialog summary

This dialog sets options to fully positive, fully negative, or random in relation to each other.

It may be used to explore an extreme contrast picture for inter-correlation of options.

Full positive alignment

> At least one option must be identified as belonging to this category (to allow other options to be orientated).

> All options selected for full positive alignment are sorted in **_ascending_** order of appeal. A high level of inter-correlation will be achieved amongst these options.

> Blocked cases are sorted to the lowest level. (This change may have a significant impact on share, advantage, and disadvantage.)

Randomise options

> Selecting this optionbutton will enable its "Maximum deviation from zero for any r" editbox. The default level is ±0.1 (or 1% common variance). This sets the maximum product-moment correlation between any two options. Reducing this criterion further can substantially extend execution time, especially as the number of options increase. If any attempt between any two options takes 250 iterations you will be notified of the problem of achieving your criterion and the program terminated so you can alter the default correlation level.

> Select any options you wish to explicitly randomise from the dropdown boxes.

Full negative alignment

> Full negative alignment takes its meaning by contrast with "Full positive alignment".

> All options selected for full negative alignment are sorted in descending order of appeal. A high level of inter-correlation will be achieved amongst these options.

> By contrast, these options will have a high level of negative correlation with options selected for full positive alignment.

> Blocked cases are sorted to the lowest level. (This change may have a significant impact on share, advantage, and disadvantage.)

Unassigned options

> Select one of the three optionbuttons at the bottom of the dialog to include any unassigned options. Depending on the selection these options are treated as already described.

Note on randomisation: All cases in an option selected for randomisation are randomised regardless of whether they have an appeal rating or are blocked.

Note on assignments: Assignment of options to "Full positive" or "Full negative" alignment groups is clearly arbitrary. If the options were fully swapped between the two categories, the same results would emerge from the analysis.

Note on enabled settings: Only the settings you have currently selected in the dialog are enabled for program execution.

Structural analysis – Simulated series change dialog

Dialog summary

This dialog provides global impact analysis for up to five scenarios.

A global impact analysis provides aggregate share, advantage and disadvantage impacts for scenarios based on changes you make to appeal parameters.

The results are presented to enable comparisons amongst scenario results and with the unchanged base data.

An advantage of multiple scenarios is that you can evaluate share, advantage, and disadvantage impacts across a graded series of parameter changes.

The analysis is more limited than that for single scenarios. More detailed analysis can be done later for specific scenarios of particular interest.

There is no difference between the structural and functional approaches for this type of analysis – either can be used to give the same global results. (They may both be applied in a single run to produce additional scenario results.)

Set-up for parameter changes

Before entering any of your own changes you may:

1. copy the "Functional Change Settings" or

2. reset the settings to clear current entries.

3. You can make your own changes. (This is the default.)

Parameter series change table

For the set of scenarios you can select up to three different options to change.

You can select up to three of the four parameter changes available: means, standard deviations, skewness and kurtosis.

You can select the same option in more than one column but with different change parameters.

Completing the parameter series change table

1. Select one or more options to be changed using the dropdown boxes. Nothing can happen until an option is selected.

2. If you wish to randomise any of your selected options, use the dropdown boxes for inter-option correlations, at the bottom of the table, and select "Randomise". The default maximum correlation with any other option is ±0.1. Adjust this if you want. If any attempt between any two options takes 250 iterations you will be notified of the problem of achieving your criterion and the program terminated so you can alter the default correlation level.

3. If you select randomisation for one or more options, and, leave the first scenario empty of parameter changes, the first scenario results will be based only on randomisation changes.

4. If randomisation is selected the same randomised data is used in all scenarios for the option.

5. Select parameters to be changed from the parameter dropdown boxes for each option selected.

6. Insert up to five changes for the selected option parameter type in each column. Each changed parameter amount will be part of a new scenario. A "changed parameter" is a new parameter value - not just the amount of change. For example, the current mean for Option 2 may be 10 and the new scenario mean 30. Enter 30.

7. Blank cells will be treated as "no change".

8. Except where "randomised only" results are required (see third item above), only rows with at least one new parameter entry will be treated as a scenario for analysis.

Note on enabled settings: Only changed parameter settings which have an option name at the top of the column will be included in the analysis. Other entries are not enabled and are ignored for the current execution.

Note on changes to skewness and kurtosis: Where skewness or kurtosis changes cannot be achieved the scenario will be skipped and a note placed alongside the parameter specification table in the output indicating feasibility problems.

Note on randomisation: All cases in an option selected for randomisation are randomised regardless of whether they have an appeal rating or are blocked.

Functional analysis – Basic dialog

Dialog summary

This dialog covers selection of the type of functional analysis to be performed plus statistical tests.

Where a selected method involves parameter adjustment, the specific parameters to be adjusted are also selected in this dialog.

Where a selected method involves parameter change (i.e. simulation), the desired changes will be specified in a following dialog.

Insofar as they apply, the selections you make here will be used throughout Options Analysis functional analyses.

Parameter analysis

Check this checkbox to perform a functional analysis of parameters. Functional analysis of parameters aims to reveal the full or combined contribution of each or all the selected parameters to each option's share, advantage and disadvantage.

You will also need to check your selection of parameter adjustments and statistical tests.

Change analysis

Check the "Change analysis" checkbox and one of the two associated optionbuttons:

1. **Global impact analysis** to perform a single scenario simulation. Global impact analysis will evaluate the impacts of change of a new scenario on advantage, disadvantage and share.

2. **Parameter impact analysis** to perform a scenario evaluation. This analysis will evaluate, for your new scenario, the role of selected parameters affecting advantage, disadvantage and share.

For a global impact analysis, the parameter adjustment section is ignored, but consider the statistical tests.

For a parameter impact analysis, select parameter adjustments (that will be executed after your changes have been made) and statistical tests.

The parameter changes you wish to make will be able to be specified in a following dialog.

Series change analysis

Check this checkbox to perform a series of global impact analyses for a list of scenarios.

For this, the parameter adjustment section is ignored, but consider the statistical tests.

The parameter changes you wish to make will be able to be specified in a following dialog.

Note: Simulation using global impact analysis or series change analysis will yield identical results in both structural and functional approaches and may both be applied in a single run to produce additional scenarios.

Parameter adjustments

Functional adjustment analysis will analyse the separate or combined parameters (see below) for their impacts on advantage, disadvantage and share. Parameter adjustments for selection are:

1. Means
2. Standard deviations
3. Skewness
4. Kurtosis
5. Normalisation (for skewness **and** kurtosis)
6. Randomisation (for correlation effects)

Note on changes to skewness and kurtosis: Where skewness or kurtosis changes cannot be

achieved a message will be displayed indicating the problem. After clicking on the message button, the Options Analysis run will terminate so you can amend your request.

How to apply parameter adjustments

Adjustment analysis can be executed for each selected parameter separately, or may be analysed as a combination for a selection of parameters.

When the separate optionbutton is selected the results for each parameter will be independent of the others.

When a combined analysis of selected parameters is requested, a single result for the combined parameters will show the total impact of standardising all selected parameters.

Statistical tests

Not all the statistical tests apply to each type of functional analysis. Checking the "All" checkbox will ensure that all the tests available for each type of functional analysis are executed.

Functional analysis – Simulated change dialog

Dialog summary

On this dialog:

1. Consider whether you want to copy or reset the scenario details.

2. Enter any options and associated parameters you wish to change for this scenario.

3. Consider whether you wish to change inter-option correlations for the scenario.

Analysis type

The analysis option you have selected is either:

1. Global impact analysis, or

2. Parameter impact analysis.

Global impact analysis provides impacts of your scenario changes on advantage, disadvantage and share. Global analysis results compare the original appeal impacts with the scenario impacts.

Parameter impact analysis performs a functional adjustment parameter analysis on the new scenario created by the changes you make using this dialog.

Casewise re-adjustment: Unless there is a good reason, this checkbox should be left unchecked. Leaving it unchecked simplifies comparison between changed and unchanged parameter adjustment results. (Scenario changes partly modify the original casewise adjustment. This can affect parameter impact analysis. Casewise re-adjustment can be performed by checking the re-adjustment check box.)

Set-up for parameter changes

Before entering any of your own changes you may:

1. copy the "Structural Change Settings" or

2. reset the current settings to clear current entries.

3. You can then make your own changes. (This is the default.)

Note on copying "Structural Change Settings": This copying affects both the scenario settings on the current dialog and the settings for inter-correlation on the following dialogs for the present analysis. If the "Change Inter-Option Correlations" checkbox is unchecked, no inter-correlation changes will be made.

Selecting options and making parameter changes

You may:

1. change the means, standard deviations, skewness or kurtosis for up to three different options, or,

2. check the "Change Inter-Option Correlations" checkbox, or

3. do both.

Note on changes to skewness and kurtosis: Where skewness or kurtosis changes cannot be achieved a message will be displayed indicating the problem. After clicking on the message button, the Options Analysis run will terminate so you can amend your request.

Parameter change table

First select one to three different options using the drop-down boxes for "Options to be changed".

Then you can insert any changed parameters for the scenario. A "changed parameter" is a new parameter value - not just the amount of change. For example, the current mean for Option 2 may be 10 and for your new scenario mean you may want 30. Enter 30.

Blank cells and cells not enabled will be treated as "no change".

Note on enabled settings: Only parameter settings which have an option name at the top of the column will be included in the analysis. Other entries are not enabled and are ignored for execution.

Change inter-option correlations

If this box is checked you will be automatically taken to the inter-option correlations change dialog when you leave this dialog.

Functional analysis – Simulated change – Correlations dialog

Dialog summary

On this dialog you can select one of five different methods for changing the interrelations between options. Selection of an option will enable any sub-settings.

By constructing a series of well-understood relationships between options, a picture can be built of the character and significance of inter-option correlations for share, advantage, and disadvantage.

> **Note:** All of the methods here involve re-sorting or randomising of option data between at least some cases on some options. Consequently, output of casewise results reflecting such change will not usually relate case-by-case to input data listings on the ProInputData sheet.

Set all options to full positive alignment

> All the option appeal ratings are sorted in ascending order. A high level of positive inter-correlation will be achieved.

> Blocked cases are sorted to the lowest level. (This change may have a significant impact on share, advantage, and disadvantage.)

> If there is little difference between the appeals of the options in the analysis the share results can be very unstable and potentially misleading. Closely examine the levels of advantage in the results.

Randomise all options

> All cases for every option are randomised. (The order of the first option is left unchanged.)

> The objective here is to reduce the levels of inter-correlation between all options to close to zero.

> Selecting this optionbutton will enable its "Maximum deviation from zero for any r" editbox. The default level is ±0.1 (or 1% common variance). This sets the maximum product-moment correlation between any two options. Reducing this criterion further can substantially extend execution time, especially as the number of options increase. If any attempt between any two options takes 250 iterations you will be notified of the problem of achieving your criterion and the program terminated so you can alter the default correlation level.

Randomise selected option ratings

> All cases for the selected options are randomised. The objective here is to reduce the levels of inter-correlation between each selected option and others to close to zero.

> Selecting this optionbutton will enable its "Maximum deviation from zero for any r" editbox. The default level is ±0.1 (or 1% common variance). This sets the maximum product-moment correlation between any two options. Reducing this criterion further can substantially extend execution time, especially as the number of options increase. If any attempt between any two options takes 250 iterations you will be notified of the problem of achieving your criterion and the program terminated so you can alter the default correlation level.

> Select from one to three options from dropdown boxes.

Reverse alignment for selected options

> Selecting this optionbutton will enable the dropdown boxes from which you can select up to three options.

> Reverse alignment involves a reverse sort of a sorted option. Its approximate effect is to change the sign of its correlation with other un-reversed options.

> Together with selective randomisation and its original alignment result, it may be used to define systematic effects on share, advantage and disadvantage of changes in inter-option correlation.

Blocked cases for the selected options are sorted to the lowest level. (This change may have a significant impact on share, advantage, and disadvantage.)

Mix different changed inter-alignments

If selected, specifications for this procedure are in the following dialog where all options will be set to fully positive, fully negative, or random in their relations to all other options.

Note on randomisation: All cases in an option selected for randomisation are randomised regardless of whether they have an appeal rating or are blocked.

Note on enabled settings: Only the settings you have currently selected in the dialog are enabled for program execution.

Functional analysis – Simulated change – Mixed correlations dialog

Dialog summary

This dialog sets options to fully positive, fully negative, or random in relation to each other.

It may be used to explore an high contrast picture for inter-correlation of options.

Full positive alignment

At least one option must be identified as belonging to this category (to allow other options to be orientated).

All options selected for full positive alignment are sorted in *ascending* order of appeal. A high level of inter-correlation will be achieved amongst these options.

Blocked cases are sorted to the lowest level. (This change may have a significant impact on share, advantage, and disadvantage.)

Randomise options

Selecting this optionbutton will enable its "Maximum deviation from zero for any r" editbox. The default level is ±0.1 (or 1% common variance). This sets the maximum product-moment correlation between any two options. Reducing this criterion further can substantially extend execution time, especially as the number of options increase. If any attempt between any two options takes 250 iterations you will be notified of the problem of achieving your criterion and the program terminated so you can alter the default correlation level.

Select any options you wish to explicitly randomise from the dropdown boxes.

Full negative alignment

Full negative alignment takes its meaning by contrast with "Full positive alignment".

All options selected for full negative alignment are sorted in *descending* order of appeal. A high level of inter-correlation will be achieved amongst these options.

By contrast, these options will have a high level of negative correlation with options selected for full positive alignment.

Blocked cases are sorted to the lowest level. (This change may have a significant impact on share, advantage, and disadvantage.)

Unassigned options

Select one of the three optionbuttons at the bottom of the dialog to include any unassigned options. Depending on the selection these options are treated as already described.

Note on randomisation: All cases in an option selected for randomisation are randomised regardless of whether they have an appeal rating or are blocked.

Note on assignments: Assignment of options to "Full positive" or "Full negative" alignment groups is clearly arbitrary. If the options were fully swapped between the two categories, the same results would emerge from the analysis.

Note on enabled settings: Only the settings you have currently selected in the dialog are enabled for program execution.

Functional analysis – Simulated series change dialog

Dialog summary

This dialog provides global impact analysis for up to five scenarios.

A global impact analysis provides aggregate share, advantage and disadvantage impacts for scenarios based on changes you make to appeal parameters.

The results are presented to enable comparisons amongst scenario results and the unchanged base data.

An advantage of multiple scenarios is that you can evaluate share, advantage, and disadvantage impacts across a graded series of parameter changes.

The analysis is more limited than that for single scenarios. More detailed analysis can be done later for specific scenarios of particular interest.

There is no difference between the structural and functional approaches for this type of analysis – either can be used to give the same global results. (They may both be applied in a single run to produce additional scenario results.)

Set-up for parameter changes

Before entering any of your own changes you may:

1. copy the "Structural Change Settings" or

2. reset the settings to clear current entries.

3. You can make your own changes. (This is the default.)

Parameter series change table

For the set of scenarios you can select up to three different options to change.

You can select up to three of the four parameter changes available: means, standard deviations, skewness and kurtosis.

You can select the same option in more than one column but with different change parameters.

Completing the parameter series change table

1. Select one or more options to be changed using the dropdown boxes. Nothing can happen until an option is selected.

2. If you wish to randomise any of your selected options, use the dropdown boxes for inter-option correlations, at the bottom of the table, and select "Randomise". The default maximum correlation with any other option is ±0.1. Adjust this if you want. If any attempt between any two options takes 250 iterations you will be notified of the problem of achieving your criterion and the program terminated so you can alter the default correlation level.

3. If you select randomisation for one or more options, and, leave the first scenario empty of parameter changes, the first scenario results will be based only on randomisation changes.

4. If randomisation is selected the same randomised data is used in *all* scenarios for the option.

5. Select parameters to be changed from the parameter dropdown boxes for each option selected.

6. Insert up to five changes for the selected option parameter type in each column. Each changed parameter amount will be part of a new scenario. A "changed parameter" is a new parameter value - not just the amount of change. For example, the current mean for Option 2 may be 10 and the new scenario mean 30. Enter 30.

7. Blank cells will be treated as "no change".

8. Except where "randomised only" results are required (see third item above), only rows with at least one new parameter entry will be treated as a scenario for analysis.

Note on enabled settings: Only changed parameter settings which have an option name at the top of the column will be included in the analysis. Other entries are not enabled and are ignored for the current execution.

Note on changes to skewness and kurtosis: Where skewness or kurtosis changes cannot be achieved the scenario will be skipped and a note placed alongside the parameter specification table in the output indicating feasibility problems.

Note on randomisation: All cases in an option selected for randomisation are randomised regardless of whether they have an appeal rating or are blocked.

Note on enabled settings: Only changed parameter settings which have an option name at the top of the column will be included in the analysis. Other entries are not enabled and are ignored for the current execution.

Note on changes to skewness and kurtosis: Where skewness or kurtosis changes cannot be achieved the scenario will be skipped and a note placed alongside the parameter specification table in the output indicating feasibility problems.

Note on randomisation: All cases in an option selected for randomisation are randomised regardless of whether they have an appeal rating or are unaware.

Analysis summary dialog

Dialog summary

This dialog lists your analysis requests.

It provides you with an opportunity to review and change your requirements before execution.

You can also make requests for supplementary statistical data, case-by-case results listings for each analysis step, and for a copy of the raw data input to be added to the output workbook.

Type of analysis

Listed here are the seven main types of analysis with the checkboxes showing which of them you have requested.

You can uncheck any box and the relevant analysis will not be performed.

If you check any unchecked checkbox and you will be transferred to the root dialog for the analysis requested so you can proceed to specify your requirements.

If you wish to change or review an analysis you have requested, then double-click its checkbox and you will be transferred to the root dialog for that analysis. You can then re-progress through the relevant dialogs, if any.

Repeat these steps until you are satisfied.

Results sheets

Associated with every analysis you requested is the name of the output sheet where the main results will be found in the new output workbook (created automatically during program execution).

Analysis data

For most types of analysis you can request supplementary data. Look for a checkbox for the selected analysis in the column headed "Analysis Data". Checking a checkbox will generate one or more additional output sheets of data for the related analysis.

Checking any analysis data checkbox will enable the "Analysis Data" options at the bottom of the dialog. Here you can select the supplementary data you want:

1. a statistical summary for each step in the analysis,

2. a listing of the case-by-case data for each analytical step,

3. or both.

The statistical summaries for unadjusted status and each parameter adjustment or change include means, standard deviations, skewness, and kurtosis, the number of cases with appeal data, and the total number of cases for appeal and advantage. Choice statistics for unadjusted status and each adjustment or change includes the percent choosing and the number of cases.

Casewise listings include all the unadjusted and adjustment results for appeal, advantage and choice for all the options covered by the analysis.

This data can be examined in its own right or used as input for further Options Analysis.

Copy of input data

Check the copy input data checkbox at the bottom of this dialog for a copy of the raw input data to be output as a sheet in the new output workbook. The name of this sheet will be "Input Copy".

Check data entry configuration

Clicking this checkbox will switch you back to the initial data entry dialog which shows your data

sources and treatment requests. You can change all the enabled items.

Note on data documentation: Automatically output to every new results workbook is a copy of the processed and validated input. Here, any blockage codes will have been adjusted, cases with missing data deleted , case data may have been adjusted, etc., as requested by you in the data specification dialog. The name of this sheet in the new workbook will be "ProInputData". (Details of the data source and its specification will be found in columns 255-256 of this sheet. Full details of the raw data processing will be found in the Fundamentals analysis summary sheet, if requested.)

Except where results have involved sorting or randomisation the casewise listings in analysis data output will perfectly match the case listing in ProInputData.

Statistical tests

Tests are used to evaluate: the statistical significance of:

1. Changes in option choice or appeal.

2. Differences between the current distribution of choices and base model frequencies.

3. Differences between option distributions of appeal.

When tests are used to evaluate parameter adjustments, comparisons are of pre and post-adjustment status of choices and appeal.

When used with analysis of change, comparisons are between pre and post-change results.

When tests are used in analysis of simulations, the results are only projective.

In structural analysis, tests are between the current and the immediately preceding adjustment level.

In functional analysis, tests are between the current adjustment and the unadjusted level.

Test statistics include:

1. Chi square tests for goodness of fit of choice frequencies amongst options
2. Cochran's Q global test for directional change in choice amongst options
3. Sign tests for directional change in option choice
4. Runs tests for systematic change in option choice
5. K-S tests for changes in option appeal and advantage distributions
6. K-S tests for differences between option appeal distributions

Chi square tests for goodness of fit of choice frequencies amongst options

The Chi square tests compare frequencies of choice across all the options in a single global test.

Here, a frequency distribution of choices is compared to a prior or given frequency distribution to see whether the two distributions fit i.e. are the same or different.

Two Chi square tests of goodness of fit are included.

Test of change

The first Chi square test compares new choice frequencies, resulting from changes to appeal, with prior or unadjusted frequencies.

A significantly low probability is interpreted to mean that the new set of choice frequencies is different from the prior set i.e. that shares have significantly changed.

Options with zero expected frequencies are ignored in the calculation of the Chi square but are included in computing the degrees of freedom.

The Chi square tests are fast computing but, as a global test of change, Cochran's Q is usually to be preferred.

Base model fit

The second test compares choice frequencies with the base model expected frequencies.

The base model assumes that choices amongst options are random i.e. their shares are equal.

The base model percent shares are:

$$100\% \text{ / No. of options.}$$

A significantly low probability means that the adjusted distribution of frequencies does not fit the base model i.e. there are differences still to be explained.

The base model fit test is not available in simulated or series change analysis.

The test statistic is the Chi square distribution with df = options - 1.

A result of "NA" means that the statistic could not be computed or is invalid in this instance.

Cochran's Q global test for directional change in choice amongst options

This test globally evaluates significance of unidirectional changes in choice for options.

Any changes are the result of adjustment or changes in option appeal.

The method tests whether reductions in rate of choice differ significantly between the options.

The test statistic is equivalent to the Chi square distribution with *df* = options - 1.

A result of "NA" means that the statistic could not be computed or is invalid in this instance.

This test is not available in series change analysis.

Cochran's Q test is a multi-option extension of the Sign test or McNemar test which deal with single options.

Cochran's Q test assesses the prospect of finding any significant Sign test results i.e. if Cochran's Q is not significant then it will probably be unwise to interpret Sign tests post hoc.

Sign tests for directional change in option choice

The sign test is based on the direction of the changes in choice.

Change can occur as a result of adjustment or change in appeal across options.

The Sign test evaluates one option at a time.

The test is based only on cases where a change in choice occurred. It evaluates whether the changes in choices **for** relative to changes **against** could have occurred by chance.

The test statistic is **z .** The test is two-tailed.

A result of "NA" means that the statistic could not be computed or is invalid in this instance.

This test is not available in series change analysis.

Cochran's Q test is a multi-option extension of the Sign test, which assesses the prospect of finding any significant Sign test results. If Cochran's Q is not significant then it will probably be unwise to interpret Sign tests post hoc.

Runs tests for systematic change in option choice

The Runs test evaluates patterns of change in choices.

Change can occur when appeals for options have been adjusted or changed.

A Runs test can reveal systematic patterns of change for option choice in addition to increases or decreases in choice frequency. By contrast, the Sign test only detects choice change frequencies. So a non-significant Sign test and a significant Runs test suggests a non-univocal pattern of change.

An example could be systematic changes of choice against an option for those with high and low appeal ratings. At the same time those with middle ratings may change in favour of the option. Although the overall frequency of choice for the option may not change, and the Sign test would not detect any, the Runs test would detect the pattern of change.

The test is applied to each option after sorting the option by its prior or unadjusted appeal.

In evaluating patterns of change as a function of appeal level, only changes in choice are considered. Unchanged choices are ignored.

This test is not available in series change analysis.

The test statistic is z. The test is two-tailed.

A result of "ALL SAME" means that the changes were all in the same direction.

A result of "NA" means that the statistic could not be computed or is invalid in this instance.

As there is no global test over all of the options for the Runs test, caution is desirable to avoid capitalising on chance when performing analysis post hoc.

K-S tests for changes in option appeal and advantage distributions

The Kolmogorov-Smirnov test evaluates differences in cumulative distributions of continuous measures such as appeal and advantage.

Differences evaluated between distributions include central tendency, spread and shape.

Differences or change in "advantage distributions" include both advantage and disadvantage as a single distribution.

The test statistic is the maximum difference in the cumulative percentages between the two compared distributions. The test is two-tailed.

A result of "NS" means "not significant".

As there is no global test over all of the options for the K-S tests, caution is advisable to avoid capitalising on chance in post hoc analysis.

Note: Execution of this test involves classification of ratings into standard categories across the joint range of ratings. Occasionally, due to a combination of "lumpiness" in the distribution of ratings, and the category boundary cutting points, a small metric change of no substantive significance can yield a highly statistically significant result in terms of the cumulative distribution evaluated by the K-S test. This is most likely to occur in evaluating changes for adjusted appeal. A cursory evaluation of the size of the relevant parameter adjustment, and further, if needed, comparison between the respective distributions' parameters for means, standard deviations, skewness and kurtosis (in the summary statistics for the output listing for appeal), will confirm whether this is the case.

K-S tests for differences between option appeal distributions

The Kolmogorov-Smirnov test evaluates differences in cumulative distributions of continuous measures such as appeal and advantage.

Differences evaluated include central tendency, spread and shape.

The test here compares each option with each other for differences in the distributions of appeal. It is applied to either unadjusted data or data *within* a particular level of adjustment.

The test statistic is the maximum difference in the cumulative percentages between the two compared distributions. The test is two-tailed.

A result of "NS" means "not significant".

The test is not available for global change analysis or for series change analysis.

Support documents

The following files were included amongst those downloaded in this tutorial package file.

Tutorial and Help.pdf

> Provides fundamentals and elaboration of Options Analysis and associated methods.

ChangeComponents.pdf

> This file provides details on the meaning and character of component effects on appeal distributions and the varieties of change affecting these parameters. Examples of product, service, policy, practice or corporate change are provided.

ChangingOptionChoice.pdf

> This file covers the conceptual, measurement and analytical issues surrounding change of option appeal and choice from both the global and individual perspectives.

AppealAttributesAssociations.pdf

> This file lists a range of common results of mixing the antecedent option and option change appeal distributions.

PersonalChoiceModel.pdf

> This file contains a dynamic process model of individual evaluation and selection showing how antecedent option appeal, perceptions of attributes, and other inputs influence current or future option appeal and choice.

Glossary

Advantage – individual Each option's advantage is the amount by which an individual's rating of an option exceeds the highest appeal amongst other options in a selection set. Advantage of an option for an individual is either zero or a positive number.

Advantage – for those opting for an option Aggregate advantage for an option in a selection set divided by the number of individuals having positive advantage for the option i.e. inferred unequivocal choosers.

Advantage – total sample Aggregate option advantage in selection set divided by all rating that option.

Appeal A continuous or quasi-continuous unbounded bipolar measure of attractiveness or desirability of an option. It is an absolute measure with a range including extremely attractive, indifferent, and extremely unattractive. It is a total measure of option evaluation including any consideration of uncertainty. A greater than relation amongst options' appeals is the basis of option selection.

Casewise adjustment involves standardisation of the average appeal across the options for each case to the grand mean appeal for the selection set to eliminate confounding effects of differences between individual motivational levels and leniency rating errors applying across cases within each selection set. Cases are made more comparable in ways relevant to the analysis of choice shares within a population. This adjustment, while detaching each rating from its absolute meaning, maintains the distances between each individual's ratings which are the focus of Options Analysis of advantage, disadvantage, choice and share.

Choice Refers to selection by an individual. In the context of Options Analysis, inferred choice, based on highest appeal rating within a selection set, may be used to refer to either a preferred option or a behavioural intention. Reference to a "preferred option" applies where an option involves a choice that would ultimately be made by someone else; for example, proposed policies, law changes, or possible product or service developments. More commonly, reference is to a choice intention i.e. projected future choice behaviour of the respondent. Data on most likely preference or intention (collected in the same survey), is usually the appropriate criterion for assessing the validity of using the inferred choice output of Options Analysis. From choice intention, some areas of choice behaviour will be more reliably predictive than others. The relationship between intention and behaviour is an important focus for complementary validation or supportive research on mediating influences.

Direct effects of an appeal parameter are those effects on share, advantage or disadvantage created by that parameter without facilitation or suppression from any of the option's other parameters.

Disadvantage – individual Option disadvantage is the amount by which an individual's option rating falls short of the highest appeal amongst options in a selection set. It is either zero or a negative number.

Disadvantage – for those opting against an option Aggregate option disadvantage in selection set divided by the number of individuals having negative advantage for the option i.e. unequivocal non-choosers.

Disadvantage – total sample Aggregate option disadvantage in selection set divided by all rating that option.

Enzymatic effects of an appeal parameter refers to the effect of a lower order parameter on one or more higher order parameters. The concept is relevant to hierarchical analysis. Enzymatic parameters, in order from low to high, are correlation, kurtosis, skewness, and standard deviation. The mean is not an enzymatic parameter. Enzymatic effects are generated when a lower order parameter either facilitates or suppresses, negatively or positively, share or advantage effects of a ranging (higher order) parameter. For example, a relatively narrow standard deviation can help add to the share of the option with the highest mean appeal. Thus, any prior analysis of the effects of the standard deviation will account for the direct effects of the standard deviation and the relevant indirect effects of the mean. This reduces the apparent effect

of the mean in the next analysis step. Enzymatic influences are not usually obvious without analysis.

Hierarchical analysis of parameter effects involves a forwards (ranging) or backwards (enzymatic) step-by-step extraction of parameter impacts on advantage and disadvantage and share. Each step accounts for the direct and entangled effects of the target parameter that have not already been accounted for by preceding steps. (This is by contrast with an "all in" analysis where the total contribution of a single parameter or a group of parameters is analysed simultaneously, or, with factorial analysis where contributions are separately allocated to each parameter and to each of the possible types and levels of parameter combination (for interaction effects).)

Indirect effects of an appeal parameter are the effects generated by the entanglements of other parameters with the target parameter. For more see: "Parameter entanglement".

Option is an identity that is capable of evaluation and selection in its own right. It is an element in a selection set. Valid research depends critically on appropriate specification of options. The target object must be clearly identified. Commonly, an option will be an *action* object (e.g. "buying…", "using…", "voting for…"). Other important aspects of option specification includes context, timing, and the nature or role of personal involvement in selection (e.g. for self for others).

Parameter in the context of Options Analysis is usually short for "appeal parameter". It is a term descriptive of key elements of appeal distributions and their relationships. These elements include the mean, standard deviation, skewness, kurtosis and correlation plus appeal idiosyncrasy, and uncertainty. (In Options Analysis, "parameter" will not usually convey its strict statistical or mathematical meanings.)

Parameter adjustment refers to standardisation on one or more parameters of appeal distributions within a selection set to evaluate the adjustment impact on each option's share, advantage, and disadvantage.

Parameter change involves the manipulation of one or more options' appeal distribution parameters to develop a scenario and to evaluate the share, advantage, and disadvantage consequences i.e. simulation.

Parameter entanglement refers to mutual impacts amongst parameters affecting advantage and disadvantage and share effects, enhancing or suppressing the outcomes. They are analogous to interaction effects. (See enzymatic and ranging effects for examples.) Parameter entanglements can only involve the mean, standard deviation, skewness, kurtosis, correlation and uncertainty. Parameter entanglements do not involve appeal idiosyncrasy or blockage. Entanglement effects may be revealed by stepwise or controlled analysis of one or more parameters preceding analysis on one or more (other) target parameters, and comparison of the results with those of an uncontrolled analysis of the target parameter(s).

Ranging effects of an appeal parameter refer to interaction effects of an option parameter with one or more lower order parameters. The concept is relevant to hierarchical analysis. Ranging parameters, in order, are the mean, standard deviation, skewness and kurtosis. Ranging effects are generated when a higher order parameter either facilitates or inhibits share or advantage effects of a lower order (enzymatic) parameter. For example, the option with the highest mean appeal can obtain additional share through a relatively narrow standard deviation and will thereby account for some of the standard deviation's share effects i.e. it will account for the mean's direct effects and associated standard deviation indirect effects. These are ranging effects of the mean.

Selection sets are collections of options within which a choice may be made. A set may refer to a "natural" set from which a person would normally make a choice. A set may be arbitrarily restricted for research, administrative analysis or other reasons. Appropriate selection sets depend on the research objectives. As each measure of option appeal is a standalone measure within a collection of options, selection sets can be varied in the course of analysis by deleting, adding or replacing options to evaluate impact on appeal, share and advantage. (In practice, option appeal ratings will be collected within a given research context of which respondents will usually be well aware. In rather different contexts the meanings of the options may well change and selection sets may not be strictly comparable.)

Share is the percentage of choices (measured by preference, intention or behaviour) which each option in a selection set receives plus any proportion accounted for by blockage of all options. Share is inferred in Options Analysis on the basis of highest option appeal within a selection set for each individual. For options having highest equal appeal for an individual, choice probability is shared equally amongst tied options. Where there is blockage of all options within an individual's selection set, the inferred "choice" is none of these options.

Blockage refers to responses where individuals are unable or unwilling to provide an appeal rating. Examples of blockage that may rule an option unselectable include: non-recognition or non-recall, ignorance or unfamiliarity, unavailability, inaccessibility, or ineligibility, or, exclusion, elimination, indecision, deferral or inertia.

References

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Seminal work in the attitude behaviour field which has subsequently evolved into reasoned action and planned action theories. Discusses important issues in methodology of researching attitude/behaviour relations, in depth.

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Provides a summary of Thurstone's ideas on "first choice" selection based on scale position and discriminal dispersions. Also contains excellent discussion of rating scales, including sources and control for error and optimal number of measurement points.

Marder, Eric "The laws of choice: predicting customer behavior", The Free Press, 1997
A "must read" for anyone involved in market research, anyone else using survey research methods, or engaged in applied social research. Includes extensive discussion on measurement and interpretation of both choice and desirability and the relations between them. Includes such unique contributions as the "tie matrix" and the "unbounded write-in scale".

The National Election Studies, Electronic resources from the NES World Wide Web site (http://www.electionstudies.org). Ann Arbor, MI: University of Michigan, Center for Political Studies [producer and distributor], 1995-1998.

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This is the principal source used for the non-parametric tests used in Options Analysis.

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This article was the start point for Options Analysis (via Guilford above). Mainly concerned with the prediction of choice from dispersions, especially uncorrelated dispersions. Recognised the potential importance of variations in the discriminal dispersions for variation in shares of choice.

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