

Impacts of blockage and evaluation on selections

Winston Gardner contact@ResearchOnChoice.com

Comments welcome

Abstract	2
Introduction.....	2
Overview	2
Survey data collection and analysis.....	3
Nature and specification of options	3
Defining sets of options	4
The character and range of options included in selection sets.....	4
Open and closed selection sets and the role of the null option	4
Single and multiple selections	5
Selecting amongst and between options	5
The generation and management of ties	6
Blockages	7
Structuring blockage.....	9
Accounting for blockage and evaluation as components of selection	10
Introduction	10
Measuring selections	10
The individual selection model.....	12
Accounting for classes and types of blockage.....	14
Summarising case data results and obtaining option shares	15
Share component contributions – analysis of examples.....	16
Example: Hypothetical open selection set data to fit boolean model	16
Example: US Presidential Election 1996: National Election Study (USNES) Data	17
Example: New Zealand General Election 2002: NZ Election Study (NZES) Data	19
Analysis based on blockage data alone.....	20
Analysis of blockage and evaluation as dependent variables.....	20
Analytical software	21
Conclusions	21
References	22

Abstract

This paper deals with the relationships between blockages and evaluations and their joint and separate impacts on selections. Blockage makes options unselectable. Blockage sources include lack of information, supply and demand restrictions, and executive problems in decision-making. On the other hand, option evaluations generate variation in measures of selectability. Data on option selections are usually a mix of blockages and evaluative outcomes contained in a single variable or an array of variables. The presence of these different kinds of data generates obvious analytical problems. A common “solution” is to remove cases with blocked evaluations. But this results in bias and ignores the impacts of blockage on selections. This paper considers selection structures, the nature of blockages, and methods for integrated analysis of blockage and evaluative impacts on selections. By analysing blockages and evaluations together at the level of the individual, then aggregating the results, it is possible to assess their separate and combined impacts on each option’s selection share.

Introduction

Overview

This paper focuses on the impacts that option evaluations and blockages have on selections by individuals, and, selection shares within groups. “Selection” here refers to an occasion where an individual identifies one or more options as adopted with an aggregate probability of one. This generalises the process of unitary selection where, for example, buying, using, and voting, commonly resolve to adoption of one option and rejection of the rest. While adoptive situations involving verbal indications of preference or intention may be expressed similarly, there are alternative measures reflecting evaluations of likelihoods or equality of standing which may also resolve to unity with proportionate weights across options. Measures incorporating proportionate weights are able to take more sensitive account of uncertainties and conditionalities surrounding selection.

Attending to any object elicits an automatic evaluative response. (Ajzen, 2001) Evaluative input to selection involves the assessment of options in terms of a qualitative criterion in response to an associated stimulus. Criteria are rarely explicit and usually self-referentially understood such as when included in questions like, “Is this option coloured yellow?”, “Is this answer correct?”, “Do you like this option the most?”, or “How well will this option work?” Such evaluations may involve the appraisal of options with measures in the form of identifications, ranking, ratings, or probabilities, that indicate, directly or indirectly, each option’s selectability.

Successful evaluation is not the only determinant of options’ selectability. One, some or all options may be unable to be selected. When someone cannot select an option it may be said to be “blocked”. Potential causes of blockage include lack of information, supply and demand restrictions such as availability and accessibility, and executive problems such as indecision and inertia. Different kinds of blockage may apply in different situations and at different times and will vary in their relevance to different research projects.

Blockage not only eliminates prospects for an option’s selection but increases the likelihood of selection amongst remaining selectable options. Thus, selection outcomes for options depend on blockage, evaluation, or both. (The analytical processes involved here are indistinguishable from analysis of answers to any

question where one or more respondents are unable to provide a substantive answer - so the scope of these concepts is very general.)

Survey data collection and analysis

Survey data on blockage due to lack of information, such as unawareness, is one of the most common data items collected in surveys. It is a by-product of necessity: "Don't know" is an unavoidable default code. As with all sources of blockage, it is also of interest in its own right.

Conventionally, data on information blockage is analysed first, then cases with the blockage may be excluded (either explicitly or implicitly) from subsequent analysis of evaluation and selection. For example, a common requirement of correlation, regression, and related forms of analysis involves the removal of cases with incomplete measures with consequent potential of bias, loss of statistical power, and, added complexity with an implicit two-stage analytical process.

Even in simple tabular analysis there can be no balanced account on the impacts of blockage on selections. The problem is generated by the row-wise conditional effects of blockage amongst non-blocked options. Its scale depends jointly on the relative frequency of blockages and patterns of blockage across options amongst respondents. Thus, it cannot be said what proportion of selections is attributable solely to evaluative outcomes. Column-wise accounting of the raw data does not reflect the principles of between-column relationships underlying individual selection processes. Thus, in general, the roles of blockage and successful evaluation will be incorrectly estimated. Usually, the effects of successful evaluations will be over-estimated on account of the advantages evaluated options receive from the blockage of alternatives.

A commonly used practice for the collection of selection data is to ask a respondent to identify from a list of options, say, which one is preferred. The resulting raw data consists of a single item that includes an evaluative outcome, or, a blockage (or a missing value). Commonly, blockages are "don't know" or "can't say". Where the interest is limited solely to selection shares this is an efficient procedure. However, to assess the role of evaluation as a determinant of selection, the approach is inadequate. It only identifies blockage of *all* options, not of each alternative. The resulting analysis may be taken to suggest, misleadingly, that option selections are wholly the result of evaluations when this is unlikely to be true.

Nature and specification of options

This and the following two sections consider the structure of selection: the nature of options, selections sets, and selection processes.

An option is any identity or object that may be evaluated and selected in its own right. Although an option always implies one or more possible alternatives, this does not mean that more than one option is always considered by a selector. Terms such as "habit", "reflex", "primed behavior" and "response script" refer to behaviours undertaken without review of alternatives. (The alternatives are blocked.) But even when alternatives are considered they will frequently not exhaust the potential options.

Much research on selections involves a review by respondents of options that are unlikely to otherwise ever be considered in such a formally explicit way. Such procedures are only useful to the extent that they produce results isomorphic to those obtained in conditions of substantive relevance. When this relationship exists,

useful inferences may be made about the realities of selection amongst defined populations. (Marder, 1997, pp. 36-37, Ajzen and Fishbein, 1980, pp 42-7, East, 1990, pp 75-79. East, 1997, pp 124-7)

Specifying options needs to take account of the context in which individuals make their selections and in the way they view the options. For example, option selection will most often be appropriately seen as an activity or process rather than identification of a passive object. Valid specification is important for making inferences from research results to “real world” selections. Key aspects in defining options include: clarity of option identity; nature of any action involved; any reference to time or timing; on whose behalf a selection is being made (e.g. self, family, children, business, community); and, any other relevant conditions or circumstances (e.g. location). (Ajzen and Fishbein, 1980, pp. 34-35, East, 1997, p127)

Defining sets of options

The character and range of options included in selection sets

Analysis of options involves a consideration of the set or sets of which they form a part.

A key distinction in considering selection sets, is between:

1. Sets of predefined options.
2. Sets of options that individuals generate according to their current interests, context, and related memories and perceptions.

Pre-defined collections commonly serve commercial, governmental, or community or other similar research purposes. An official list of candidates, a set of referendum responses, specific policy or product options, or a list of competing products, are examples.

By contrast with pre-defined lists, individual selection sets may be expected to vary as a result of differences in personal history and current perceptions, knowledge and circumstances. Developing such lists would usually involve field work. But, even here, unavoidable arbitrariness may be involved on account of incompleteness, incapacity to always vary option presentations to fit differences in perceptions, or the highly variable character of the research topic.

Open and closed selection sets and the role of the null option

Selection sets limited to specific options (i.e. excluding unlimited alternatives) are commonly termed “closed” and selection is said to be “forced”. Selection sets with unlimited options are “open”. Options extending beyond those of specific interest may be grouped under the term “null option” which refers to “none of the other alternatives” or “anything else”. The null option is analogous to a null hypothesis in the sense that it deals with all unidentified options. “Yes/No” questions have the null option built-in, where the “Yes” option is usually specified and “No” covers everything else. Similarly, identifying the probability of a single option implies that the remaining probability covers every other possible selection.

As open selection sets are complete and exhaustive of all possible selections, probabilities for selection of all options will always add to unity. This is not always so for closed selections. Whenever all specified options are blocked for an individual, the selection probability will sum to zero, (although there is implicit selection of the null option with a value of unity).

Closed sets can generate artificial results. This occurs if a substantively significant proportion of respondents, when offered an *open* selection:

1. identify the null option by default on account of blockage of all the specified alternatives, or
2. explicitly select the null option.

When it is not clear from questioning whether a selection is open or closed, difficulties of interpretation arise. This especially occurs when open selections are intended but not expressed, with resulting ambiguity. Clarity on selection set closure is obviously important for both respondents and researchers.

One consideration in explicitly using the null option is its difference in character from other options. In some ways the null option implies a different and additional question. Most sets of options have a common thread or theme. For example, if selection from a full range of banks is being considered, then banking is the theme. "None of these" may be seen to stand outside the theme. For some choice occasions it may be appropriate. For others it may introduce a mode of thinking alien to a targeted selection process, and, in others again, it may have mixed relevance. For example, in selecting travel destinations for a holiday, only the destinations would be relevant for some, while, for others, an appropriate option would be to stay at home i.e. no travel.

A key avenue for reducing use of an explicit null option when considering the substantive options involves filter questions to remove cases for whom the specific options do not apply. In such filtering it is important to distinguish cases that are filtered on account of blockage and those filtered on account of active selection of the null option. All these cases will need to be re-included in the whole sample analysis using methods such as those outlined below to correctly calculate results.

Single and multiple selections

Selecting amongst and between options

Views on single versus multiple selections differ according to perspectives on whether the evaluations in question are amongst or between options. Selecting *amongst* options may be seen as involving the application of a criterion of sufficiency. On the other hand, selections *between* options may be viewed as additionally involving the identification of one or more options as being the *most* sufficient, appropriate, correct, or best.

Each option is separately assessed when making choices involving identification of an option with a sufficiency criterion. All, some, one, or no options in a set may be identified as meeting the criterion. Here, the null option is always implied by non-selection of *all* identified alternatives. The inferred null option results can be added to substantive selections following data collection but preceding analysis. When the null option is a candidate for active selection it should be explicitly included amongst the list of options so as to directly impact on selection shares.

By contrast with choice amongst options, choice between options is more restrictive. Question wording, such as "the most ...", "the least ...", "the first ...", "the single preferred ...", "the correct ...", is typical, so that only a specific number of options can usually be identified as having the target quality, often just one. Here, there is a need to decide whether the choice is to be forced.

1. When the selection is fully forced, cases where all options are blocked are able to be separately accounted for and the resulting analysis of selected options qualified as incomplete.
2. When the null option is explicit, it is available for active preference, or, automatic selection when all the remaining alternatives are blocked.

The distinction of selecting amongst and between options may be useful but it is not always clear-cut. Selecting amongst options may be seen as identifying selected options with equal selection weights. These selections are indistinguishable from the same options tied for a “first” selection.

An important difference concerns the need for detailed versus summary data: a matter of research depth versus collection cost. Option-by-option evaluations in terms of rankings, ratings, or probabilities are capable of providing insights on inter-option relationships which are not possible with the more economical “first choice” data. But even with “first choice” data it is still necessary to collect option-by-option data on blockage to obtain an accurate assessment of the impacts of evaluations on selections.

The generation and management of ties

How ties are handled is important in the design and application of analytical methods for the calculation of individual selection probabilities and for selection shares.

The generation of ties depends on questionnaire design, measurement methods for evaluations, the practicalities of data collection in the field, respondent psychology, and the potentially ambiguous conceptual status of ties as evaluative outcomes or blockages.

In practice, enforcing single “first choice” selections will often be seen as insensitive to the realities of respondent evaluations. For example, a respondent may, explicitly or implicitly, eliminate most options but be unable to choose between those remaining because they are seen as the same. For “first choice” only collections, such a situation is problematic. Accepting multiple selections is a straightforward solution so long as analysis yields a selection probability of unity over the option set with ties treated as shared equi-probable selections. This procedure applies whenever multiple selections of options are explicitly identified or implicitly inferred from rankings or ratings.

This procedure is not applied where respondents assign probabilities. Probabilities have the concept of ties is built-in with selections proportionate to the probability assigned. Thus, probabilities may be described as weighted ties pre-adjusted to yield an aggregate result of unitary selection across all options.

Not all ties are substantively the same. Nor do ties necessarily imply selection. Ties may reflect alternating or rotating selections over time, equality of standing, substitutability, uncertainty, unresolved equivocation or vacillation, or simple indecision. Alternating or rotating selections of options seen as having equal merit or as substitutable might be appropriately treated as valid evaluations. Unresolved equivocation, vacillation, or an inability to say, represents blockage. Thus, a basic design consideration is whether individual ties need to be classified as shared selections or blocked evaluations, or, perhaps even a mixture when more than two options are tied. When of likely significance, it would be necessary to ask the relevant clarifying questions in the field and adjust the analysis accordingly.

Blockages

Blockage effects are generated across a set of options when any option cannot be selected. There are two categories of blockage effect on option selection:

1. The elimination of prospects for an option's selection.
2. The increase of prospects for an option's selection on account of blockage of alternatives.

Some sources of blockage prevent initiation of a relevant evaluation. These include lack of recognition or recall, insufficient familiarity or knowledge. Unavailability, inaccessibility or ineligibility are external blockages to selection (although not to evaluation). Other blockages, such as option exclusion or option elimination by the decision-maker, actively forestall evaluation or remove options before an evaluation is completed. Other blockages again, such as indecision, deferral and inertia or lack of interest represent evaluative disabilities.

Fuller information on sources, types, and character of blockage is to be found in Chart 1.

The relevance of different sources of blockage will vary from one study to another according to:

- **Unavoidable response constraints.** If an individual is unaware of an option there is little that he or she can say about it. The frequency of occurrence is important to any analysis of selection data.
- **Purpose of the research.** Treatment of blockages will depend on research objectives and the nature of the options considered. Some blockages may be ignored, some may be assumed to not apply, some may be elaborated, and others may be merged. Where, for example, the intention is to measure recognition of brand names regardless of whether that brand is to be found in the respondent's locality, then blockages such as availability, accessibility and inertia will not be relevant. However, if product purchase is the focus then such blockages will be key. In the use of government services blockage issues are often seen as central. (See for example Meager et al, 2006)
- **Structure of the selection process.** Does selection require a single choice, for example. If it does and an individual cannot choose between options, a blockage of indecision automatically arises. In other situations option equality might be treated as tied selections. Other potentially relevant forms of blockage here include option exclusion or elimination where some options are rejected or removed prior to full evaluation. Understanding the role of such blockages may be critical for effective marketing action.
- **Nature and timing of behaviour involved in selection.** The distinction between intention and substantive action is frequently relevant to the interpretation of survey data. Where significant effort is involved in the active selection of an option, such as in the acts of buying or voting, a sufficiently high level of motivation is needed to avoid inertia. This contrasts with the relatively low level of motivation needed to respond to a questionnaire item. This contrast generates expectations of varying results between the two conditions of selection on account of differences in blockage. Data on motivational levels and on variations in context and conditionality of options may also be required.

CHART 1: SOURCES AND CHARACTER OF BLOCKAGE EFFECTS

Type	Character	Notes
Lack of information		
No recognition	Option is not known.	According to the nature of the option and the type of knowledge required, either recognition or recall may provide the appropriate test of awareness of option identity.
No recall	Cannot retrieve option from memory.	
Ignorance	Awareness of option but insufficient know-how or capacity to make selection.	Information required for evaluations varies depending on the nature of options, decision-makers and circumstances. Typically, option selections made on grounds of correctness will be influenced by knowledge or intelligence. Likewise, high involvement evaluations will require more information or experience.
Unfamiliarity	Awareness of option but insufficient information or experience to make selection.	
Supply and demand constraints		
Unavailability	Option is not provided for selection.	Usually a supply issue e.g. stockouts, legislative prohibition, no provision.
Inaccessibility	Option is available but cannot be secured due to personal circumstances or characteristics or conditions of supply.	Includes such constraints as affordability, distance, hours or opening. Also covers characteristics like lack of confidence or personal capabilities.
Ineligibility	Qualifications to select an option are proscribed.	For example: need for ticket or coupon, being young or old enough, living in a specific place, being the right sex.
Evaluative and executive constraints		
Exclusion	Option not considered relevant. Exclusion applies mainly to open-ended selection sets where evaluators determine their own set sizes.	For example, exclusion of options may occur where the range of actively considered options is viewed as sufficient. Amongst experienced decision-makers making intuitive selections in their field, often only one option is considered.
Elimination	Option rejected i.e. ruled out of contention. Here, the evaluator considers any such option should not belong to the selection set.	Applied where option is thought to be irrelevant, too unattractive or insufficiently attractive and thus not fully considered for evaluation along with other set members.
Indecision	(a) Occurs implicitly, when the number of options selected exceed those allowed. (b) Occurs explicitly, where a person cannot say whether an option meets a selection criterion.	Indecision is usually a residual condition for some options after others are rejected or blocked. Indecision may be incorrectly dealt with as equally likely selections rather than blockage. Such treatment has been shown to be invalid when there are differences in familiarity between options, for example. (Panagakis, 1989) Treatment of indecision as blockage avoids such bias.
Deferral	Selection postponed due to uncertainty about possible changes to options or circumstances.	As with indecision, deferral may apply to one, some, or all options.
Inertia	Insufficient motivation to select any non-null option in a set.	Applies more to choice action rather than intention (because of the additional energy required). May be viewed as an extreme form of elimination.
Enhanced selectability through blockage of alternatives		
Blockage complement	Generated automatically when other options are blocked. This is the complement of <i>all</i> other sources of blockage effects.	As the number of alternatives reduce so the likelihood of selection of each remaining option increases. The scale of the impact depends on the number of options in a set and the proportion of all options blocked.

Structuring blockage

Collecting data on each individuals' blockages, if any, for the options in a set, will be adequate for a complete analysis of current blockage contributions to selection. However, eliminating current blockage will not necessarily be sufficient to enable selection. Removal of one blockage means that subsequent blockages may come into play. An individual may have multiple potential blockages for one or more options.

When potential blockages are viewed as arising sequentially, the first occurring blockage is sufficient to reduce any option's selection prospects to zero. Subsequent potential blockages may be seen as currently precluded. Examples include the need for awareness of an option to precede sufficient knowledge, and, for availability to precede accessibility. Setting priority for blockages is likely to be helpful in developing a conceptually tiered approach to the simulation and management of blockages over time. Such a set of ordered relationships may be arranged in a hierarchy as in Figure 1.

Figure 1: Hierarchy of blockages to option selection

Blocking factors		Status of constraints				
		Informational		Supply and demand		
		Unaware	Don't know enough	Unavail-able	Inaccess-ible	Ineligible
Informational constraints	Unaware	Block	NA	NA	NA	NA
	Don't know enough	OK	Block	NA	NA	NA
Supply and demand constraints	Unavailable	OK	OK	Block	NA	NA
	Inaccessible	OK	OK	OK	Block	NA
	Ineligible	OK	OK	OK	OK	Block

OK = Not a constraint

NA = Not applicable on account of prior constraint

Variations in blockage, degrees of elaboration, and alternative orderings may apply amongst different selection sets. They may be based on researched or perceived logical or causal ordering, or importance or relevance for applied purposes. With such a hierarchy it is possible to specify blockages uniquely for each option for each case when data on multiple potential blockages is collected.

To fully model the consequences of blockage reduction or elimination it is necessary to take account of such multiple subsequent sources of blockage and perform multiple analyses and simulations on the progressively emergent scenarios. Such analysis is not further considered in this paper but may involve the replication of the methods outlined below over each scenario.

Accounting for blockage and evaluation as components of selection

Introduction

This section concentrates on individual option selections with methods to:

- measure selections,
- account for the separate contributions of blockage and evaluation, and
- elaborate the component contributions of blockage according to type and category.

These steps precede aggregation of components across individuals for the analysis of shares of selection, which is covered later.

Measuring selections

Probability concepts can be applied to measure all forms of individual selection. They are also consistent at the aggregate level with the concept of “share” where they may be viewed as average probabilities (although more commonly discussed in terms of percentages).

Different research objectives will require different measurement models. One objective of option selection analysis may be thought of as identifying options of choice or preference, commonly just a single option. Another frequent objective is to identify options falling into a class of selectables. Other common objectives include the assignment of selection probabilities or preference weights to options or an assessment of rankings or ratings on the underlying criterion measure from which selection may be inferred rather than measured directly.

Each measurement model has its own implications. For example, where a single preferred option is to be identified, remaining options are assumed to have no chance of selection. By contrast, the assignment of selection probabilities implies that any option with a non-zero probability, however small, might actually be selected.

Blocked options have a zero selection probability in all measurement models but should always be identified in the data as blocked or coded according to blockage type to enable analysis of its component contributions.

Both the selection context and the research objectives will jointly indicate the relevant model. For example, obtaining good estimates of selection shares may suggest methods which closely simulate actual selections, while, obtaining insights on changeability amongst the alternatives may involve continuous measures for each option’s attractiveness to reveal degrees of difference in the appeal of underlying option selections.

The satisfactory modelling of different types of selection will involve variations which take account of these differing selection purposes, situations, and measurement methods.

Boolean selection without ties

Boolean selection applies where an option is either chosen or not chosen (on account of non-selection or blockage). It provides an appropriate model where

respondents select either one or no options from the selection set. Where none of the specific options is selected, the null option is implied even when the set is closed.

When an individual makes multiple selections under this model these can only be treated as blocked on such grounds as indecision or deferral. (In such cases, all options, not just those that are tied, need to be treated as blocked.)

The boolean selection probability for a single option's selection by an individual is:

$$P(O_i) = E_i \text{ where: } E_i = \text{Option } O_i \text{ evaluated and selected. (1 = true, 0 = false).}$$

Boolean selections with ties

The formula for selection with ties applies where two or more options may be picked by a respondent. For example, in identifying which options have a quality; all, some or no options (with an implied null option) may have that quality.

Here, co-equally likely selections would usually be treated as successful evaluations. However, it is also still possible to treat tied selections as blockages when appropriate, such as where, say, indecision was indicated. This involves looking more closely at the nature of each evaluation. Follow-up questioning on tied selections is required to determine whether each option should be regarded as selected or blocked.

For Boolean selections with ties the casewise selection probabilities need to be spread equally over the tied options so that they still sum to unity over each individual's set. An implication is that lack of differentiation is discounted over the co-equal options. Here, selection probability for a single option for an individual is:

$$P(O_i) = \frac{E_i}{\sum E} \text{ where: } \sum E = \text{the sum of the first ties for the set and } \sum E \geq 1$$

Assigned probability selection weights

Respondent's direct probability assignments to options may be viewed as reflecting hypothetical outcome frequencies of innumerable selections by an individual, or, as subjective selection likelihood weightings.

Assignment of probabilities requires special care in data collection. For each individual the option probabilities for each set must add to unity. For open sets this may be assured with the inclusion of an explicit null option. Unless the null option is overtly considered it will be unclear whether any probability residual short of unity is a measurement error or a null option selection probability. The only exception to summing to unity is for closed sets where all the options are blocked and the probability of selection for the set for an individual will be zero.

Free allocation of selection probabilities to each option in a set is unsatisfactory. Such probabilities will not usually sum to unity and cannot legitimately be re-scaled. The constraint of unity is an intrinsic and unavoidable part of this assignment process.

One workable procedure for obtaining constrained probabilities is to allocate a given number of tokens or votes, say 10, across preferred options, to reflect selection weights. (Marder, 1997, pp 41-45)

Probability for a single option for an individual is:

$$P(O_i) = P(O_i)_{Assigned} \quad \text{Collected directly from respondent and summed with other options to yield unity (or zero for closed sets where all options are blocked) over the set.}$$

Selections based on rankings and ratings

How data consisting of rankings or ratings are handled depends on the purpose of the analysis. If the intention is to identify the highest choice selection for each case, then the identification of the premier rankings or ratings, together with an adjustment for ties, would serve this purpose. Where an individual has a single option with a premier ranking or rating, it is assigned a value of one, and otherwise, zero. Where this premier ranking or rating is shared with other options, its value is discounted according to the total options sharing that ranking or rating. Thus, the probability for a single option for an individual is:

$$P(O_i) = \frac{E_{iM}}{\sum E_M} \quad \text{where } M \text{ refers to the presence of the maximum or minimum, as applicable.} \quad \text{and } \sum E_M \geq 1$$

$E_M = (1 = \text{true}, 0 = \text{false})$

For analysis of options in terms of their meeting or exceeding a general criterion level, the application of a cutting point will be appropriate. For example, in the case of bi-polar attributes, the identification of all positive assessments as a criterion for differentiation might be appropriate and each option assigned one or zero accordingly, but again discounted by the number of qualifying options. Here, an individual's probability for an option's selection would be:

$$P(O_i) = \frac{E_{i \geq c}}{\sum E_{\geq c}} \quad \text{where } c \text{ is the cutting point, and } \sum E_{\geq c} \geq 1$$

The individual selection model

The probability of an individual's selection for all options in a set is:

$$P(\text{Set}) = \sum_{i=1}^O P(O_i)$$

The probability for each individual's selection for any set will always add to unity except for closed sets where all options are blocked when the probability for the set is zero.

Now, consider the case where there are no blockages and no apparent differences between options within a set. In accordance with Jacob Bernoulli's rule of "indifference" or "insufficient reason" for selecting one option rather than other, the number of options in a set determines the a priori expectation for each option's

selection. (Bunge, 1963, pp. 234-5) This provides the a priori starting and reference point for model development:

Base selection expectation of option(i) = 1 / Number of options in the set

Each individual's data can be used to model selections for each option in turn. Deviations from the base selection probability are attributable to selection blockage or evaluation, or both. The presence of a blockage for a specific option ensures there will only be a blockage adjustment and a selection probability of zero for that option. On the other hand, if a selection set for an individual contains no blockages, then there will only be evaluative adjustments to the base expectation for each of the options.

Where a set contains one or more blockages, the primary impact on selection is reduction of alternative options available. This increases the selection probabilities amongst remaining selectable options. For example, if two of four options are blocked, then the likelihood for selection of each of the remaining options is increased, from 0.25 to 0.50. The difference is the adjustment attributed to blockage of alternatives.

In summary:

Probability of an option's selection = Base expectation + Blockage adjustment + Evaluative adjustment

The three terms composing the individual's selection probability may be specified as:

$$P(O_i) = \frac{1}{\sum O} + \left(\frac{S_i}{\sum S} - \frac{1}{\sum O} \right) + S_i \left(P(O_i) - \frac{1}{\sum S} \right)$$

where:

O Option in the selection set. (To sum, count the options in the set.)

S Selectable option in the set i.e. not blocked. (1 = true, 0 = false)

S_i Option O_i selectable. (1 = true, 0 = false)

and $\sum S \geq 1$

The first term sets the a priori selection probability. The second term generates a positive or negative adjustment depending on blockage of alternatives. If the option is blocked then only the negative part of this second term will apply. Otherwise, the positive blockage contribution is the difference between the a priori probability of selection amongst the selectable options and that for all options in the set. The third term, which only applies where the option is selectable, varies its size and direction according to the difference between the selection probability for the option and the a prior likelihood of selection amongst the selectable options in the set.

A general determinant of the sizes of blockage and evaluative contributions to each option's selection probability is the number of options in a set. Here are some patterns of impact of the number of options in sets. In larger sets both positive and negative effects of one option's blockage are moderated by the lower chances of being selected regardless. The same applies for the negative impacts of unsuccessful evaluations of selectable options in larger sets. However, an

evaluation leading to an option's selection will have a larger positive contribution to selection probability the larger the number of selectable options. All these relations are hyperbolic in character with the most significant changes in impact occurring at a decreasing rate over sets of two to seven options.

The model for option selection also indicates that where all but one option in a selection set are blocked, the selection of the remaining option will be automatically attributed to blockage rather than evaluation. This applies to both open and closed sets. However, where the set under analysis is arbitrarily treated as closed, and there are a significant number of such cases, a sounder interpretation may be obtained if an inferred null option is added to the analysis. When this is done the selection will be attributed to evaluation (since there is now a residual alternative from which to choose).

Accounting for classes and types of blockage

Sub-analysis of blockage can be performed in terms of classes of directional effect and according to the types of blockage source (awareness, availability, etc.) Both types of analysis can be usefully performed together.

There are three general classes of adjustment for blockage:

1. For closed sets only: For every option where all options are blocked, adjustments are always negative and reduce all option selection probabilities to zero for that case. (In open sets the null option is always available for selection, thus, there will be no cases in this class.)
2. Blocked options with selectable alternatives will also always have negative blockage adjustments that reduce their selection probability to zero. (These negative adjustments are complementary over the set of options to the positive adjustments referred to in the next class.)
3. Selectable options with blockages amongst the alternatives will have blockage adjustments which are always positive on account of their chances for selection being enhanced.

And for analysis of blockage type, wherever an option is blocked for an individual its type of blockage is uniquely identified with the option. However, for selectable options it is the blockage of alternative options that determines the types of blockage contribution. Indeed, if blockages associated with alternative options are of various types, then each type will each make its proportionate contribution. Appropriate elaboration of the basic formula incorporates each of these classes and types of adjustment as follows:

$$P(O_i) = \frac{1}{\sum O} + \left[B_T \left(-\frac{1}{\sum O} \right) + \left((1 - B_T)(1 - S_i) \left(-\frac{1}{\sum O} \right) \right) + S_i \left(\sum_{j=1}^T \left(\frac{\sum B_j}{\sum B} \left(\frac{S_i}{\sum S} - \frac{1}{\sum O} \right) \right) \right) \right] + S_i \left(P(O_i) - \frac{1}{\sum S} \right)$$

where:

- B_T All options in the set blocked. (1 = true, 0 = false)
 B Option in set is blocked. (1 = true, 0 = false)
 B_j Option in set blocked by blockage type j. (1 = true, 0 = false)
 and $\sum B \geq 1$

Summarising case data results and obtaining option shares

The preceding discussion has been limited to the individual case. To obtain aggregate summary results, the data for the three terms, (base expectation, blockage and evaluation), can be summed and averaged separately, to obtain:

1. The expected share. This is equivalent to each individual's selection probability for each option i.e. one divided by the number of options in the selection set.
2. The share effects for each type of blockage by the following classes:
 - a. Losses associated with blockage of all options (which only applies to closed sets).
 - b. Losses associated with blockage of one or some options.
 - c. Gains to an option associated with blockage of alternatives.
3. The share effects of evaluations after having been adjusted for blockage effects.

These component summaries provide the analytical tools for interpreting the effects of blockage and evaluation on shares.

The aggregate share for each option based on this analysis is:

$$P(O_i)_T = \frac{1}{\sum O} + \frac{\sum_{j=1}^N \sum_{k=1}^T \sum_{l=1}^C B_{jkl}}{N} + \frac{\sum E}{N}$$

where

- $P(O_i)_T$ Selection probability for Option i for the sample.
 B_{jkl} Blockage contribution for case by type by class.
 E Evaluative contribution to selection for case.
 N Number of cases.

Selections from sets which include the null option in the analysis, will always account for 100% of the option shares. In this case:

$$100\% = \left(\sum_{i=1}^O P(O_i)_T \right) \times 100$$

To the extent that for some individuals **all** the specific options in the set are blocked and where the null option is not added to the analysis, the aggregate percentage

share for options in a set will fall short of 100%. Implicitly, the residual cases have chosen the null option. Here:

$$100\% = \left(\sum_{i=1}^O P(O_i)_T + \frac{\sum B_T}{N} \right) \times 100$$

where B_T refers to each wholly blocked set of options for a case. (1 = true, 0 = false)

Share component contributions – analysis of examples

Example: Hypothetical open selection set data to fit boolean model

The example data in Table 1 shows the options blocked or selected from an open selection by four cases. The following tables progressively elaborate the blockage effects.

Table 2 shows the simple percentages of evaluated and blocked selections for each option.

Table 3 shows the respective contributions of blockage and evaluation to option shares in the form of deviations from the a priori selection rate. (Note that while the adjustment for evaluations is –27%, this does not violate the 0-100% range as the adjustments are hierarchical; first the base, then blockage, then evaluation.)

Table 4 separates blockage into positive and negative component contributions.

Tables 5 and 6 partition blockage further into component sources – here, unawareness and unavailability.

Table 1: Hypothetical blockage and evaluation data

	Option 1	Option 2	Option 3	Null Option
Case 1	Unaware	Unavailable	Unaware	Chosen
Case 2	Chosen	Not Chosen	Not Chosen	Not chosen
Case 3	Chosen	Unaware	Unavailable	Not chosen
Case 4	Not Chosen	Unavailable	Chosen	Not chosen

Table 2: Percentage of each option blocked and evaluated

	Option 1	Option 2	Option 3	Null Option
Blocked	25%	75%	50%	0%
Evaluated	75%	25%	50%	100%
Totals	100%	100.0%	100.0%	100.0%

Table 3: Component contributions analysis of total shares

	Option 1	Option 2	Option 3	Null Option	
Base model shares	25.0%	25.0%	25.0%	25.0%	100.0%
Blockage effects	+2.1%	-18.8%	-10.4%	+27.1%	0.0%
Evaluation effects	+22.9%	-6.2%	+10.4%	-27.1%	0.0%
Option shares	50.0%	0.0%	25.0%	25.0%	100.0%

Table 4: Component contributions of blockage effects to shares

	Option 1	Option 2	Option 3	Null Option	
Blockage of options	-6.3%	-18.8%	-12.5%	0.0%	-37.5%
Blockage of alternatives	8.3%	0.0%	2.1%	27.1%	37.5%
Impacts of blockage	2.1%	-18.8%	-10.4%	27.1%	0.0%

Table 5: Share impacts for blockage - Unawareness

	Option 1	Option 2	Option 3	Null Option	
Blockage of options	-6.3%	-6.3%	-6.3%	0.0%	-18.8%
Blockage of alternatives	3.1%	0.0%	0.0%	15.6%	18.8%
Impacts of this blockage	-3.1%	-6.3%	-6.3%	15.6%	0.0%

Table 6: Share impacts for blockage - Unavailability

	Option 1	Option 2	Option 3	Null Option	
Blockage of options	0.0%	-12.5%	-6.3%	0.0%	-18.8%
Blockage of alternatives	5.2%	0.0%	2.1%	11.5%	18.8%
Impacts of this blockage	5.2%	-12.5%	-4.2%	11.5%	0.0%

Example: US Presidential Election 1996: National Election Study (USNES) Data

The following example analysis is for data collected over two months preceding the 1996 US election. (Rosenstone et al, 1996) The USNES was designed to provide a nationally representative sample of the American electorate. The analysis here is based on the weighted sample of 1714 respondents' thermometer scale ratings of liking for each of the three main candidates. The thermometer scale enables each respondent to rate the warmth of their feelings for or against each candidate on a scale ranging from 0 to 100, where 50 indicates indifference.

Inferred preferences, based on the highest of the thermometer scale ratings, may be treated as surrogates for electoral choice. Where candidates' ratings were tied, the probabilities of selection were split two or three ways, as applicable. The set of three options was treated as closed. (Preferences based on this procedure yield correct predictions of vote intentions approximately 95% of the time.)

Only one form of blockage was specified in this analysis: unawareness of the candidate. Additional possible forms of blockage that might have been included were, indecision (identified as tied first ratings), and, elimination (a third non-tied candidate when the other two were tied for first). These other sources of blockage applied to 11.7% of respondents.

Table 7 shows the percentage of blocked selections on account of unawareness for each of the candidates: 0.4% for Clinton, 1.9% for Dole and 3.1% for Perot. This data cannot be assumed to measure direct effects on shares as these depend on the patterns of unawareness amongst respondents, not just the gross figures.

The adjustment coefficients for unawareness are shown in Table 8. The 95% confidence intervals for each adjustment coefficient do not overlap. The results show that of Clinton's share relative to that expected, 0.8% point was gained from better awareness, while Perot lost nearly 1% point. Differences in unawareness provided an 1.7% advantage to Clinton with respect to Perot and 1.1% with respect to Dole. About one person in three hundred, or 0.3%, were unaware of all three candidates. This is shown in the last column of Table 9 and accounts for the residual making up 100% of respondents.

Table 9 shows the patterns of losses and gains attributable to unawareness across the candidates. While Dole and Perot show losses attributable to unawareness they also show some gains from the unawareness of others. Clinton on the other hand gains almost wholly from the unawareness of others.

While the effects of the blockage of unawareness described here are of modest substantive significance, the effectiveness of the approach in illuminating the respective contributions of selection blockage and evaluation can be readily seen.

Table 7: Percentage of each option blocked or evaluated

	Clinton	Dole	Perot
Blocked by unawareness	0.4%	1.9%	3.1%
Evaluated	99.6%	98.1%	96.9%
Totals	100%	100.0%	100.0%

Table 8: Component contributions analysis of total shares

	Clinton	Dole	Perot	
Base model shares	33.3%	33.3%	33.3%	100.0%
Blockage effects	+0.8%	-0.3%	-0.9%	-0.3%
Evaluation effects	+22.9%	-0.4%	-22.5%	0.0%
Option shares	57.1%	32.6%	10.0%	99.7%

Table 9: Component contributions of unawareness effects to shares

	Clinton	Dole	Perot	
Losses from unawareness of all options	-0.1%	-0.1%	-0.1%	-0.3%
Losses from unawareness of one or some	-0.0%	-0.5%	-0.9%	-1.6%
Gains from unawareness of alternatives	+1.0%	+0.4%	+0.2%	+1.6%
Share impacts of blockage	+0.8%	-0.3%	-0.9%	-0.3%

Example: New Zealand General Election 2002: NZ Election Study (NZES) Data

The following example analysis is based on weighted data of 5,783 respondents, broadly representative of the electorate, surveyed following the 2002 NZ general election. (Vowles et al, 2002)

Likeability selections of political parties are inferred from ratings on a zero to ten likeability scale. The analysis is limited to the seven parties that were successful in obtaining parliamentary representation. (The electoral system is a variant of proportional representation.) Of the respondents only 148 (2.5%) did not provide at least one rating of these parties. These cases have been excluded from the current analysis.

Inferred selections were based on the highest ratings with ties represented as split selection probabilities amongst the co-equal ratings. The set of seven options was treated as closed. As with the USNES data on presidential likeability, inferences based on the NZ likeability scales may be considered as surrogates for electoral choice. Preferences based on highest ratings yielded correct predictions of voting for each party, 90-97% of the time.

Blockage occurred whenever a respondent was unable to provide a likeability rating for an option or eliminated or excluded an option from likeability evaluation. The frequencies for evaluation and blockage for each party are shown in Table 10. Blockage ranged from 1.1% to 17.1% over the parties.

The impacts of evaluation and blockage on inferred selection outcomes are shown in Table 11. Of interest in this particular example are the relatively modest impacts of blockage on shares of those parties having substantial proportions of blockage. For example, the Progressive Party, with 17.1% of respondents blocked, experienced a 2.2% negative blockage adjustment (although it accounted for just under half the effect on its adjusted share). The contrast between the isolated and group-wise effects of blockage is because, in the present case, most blocked options share their blockage with other options thus spreading blockage effects amongst them. These contrasting results show the importance of integrated selection and blockage analysis within the context of share.

The aggregate effects of blockage shown in Table 11 reveal that up to 2.0% was gained by a party from blockage effects and up to 2.2% lost by another. Such results are the net effects of such losses and gains across all options in the set. Table 12 shows that a total of 7.6% points of share were reallocated amongst the seven parties on account of blockage. More than half the blockage loss was accounted for by two minor parties, while, just under half of the blockage gain was accounted for by the two major parties.

Table 10: Percentage of each option blocked and evaluated

	National	Labour	NZ First	Act	Greens	Prog-ressive	United Future
Blocked	1.5%	1.1%	4.4%	7.5%	4.5%	17.1%	16.8%
Evaluated	98.5%	98.9%	95.6%	92.5%	95.5%	82.9%	83.2%
Totals	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 11: Component contributions analysis of total shares

	National	Labour	NZ First	Act	Greens	Prog-ressive	United Future	
Base shares	14.3%	14.3%	14.3%	14.3%	14.3%	14.3%	14.3%	100.0%
Blockage effects	1.6%	2.0%	0.6%	-0.3%	0.4%	-2.2%	-2.1%	0.0%
Evaluation effects	3.4%	25.0%	-4.7%	-6.5%	-6.0%	-8.7%	-2.6%	0.0%
Option shares	19.3%	41.3%	10.2%	7.5%	8.8%	3.3%	9.7%	100.0%

Table 12: Contributions of blockage effects to shares

	National	Labour	NZ First	Act	Greens	Prog-ressive	United Future	
Losses	-0.2%	-0.2%	-0.6%	-1.1%	-0.6%	-2.4%	-2.4%	-7.6%
Gains	1.8%	2.2%	1.2%	0.7%	1.1%	0.2%	0.3%	7.6%
Totals	1.6%	2.0%	0.6%	-0.3%	0.4%	-2.2%	-2.1%	-0.0%

Analysis based on blockage data alone

It is not necessary to have evaluation data to perform an analysis of blockage contributions to share. Blockage data across the options for each case in the sample is all that is needed. This is because of the hierarchical nature of the analysis.

All options that can be evaluated are simply defined as options that are “not blocked”. Since data for the first two terms on the right-hand of the basic equation are available, the blockage components can be calculated. This is readily extended to analysis of classes and types of blockage.

Analysis of blockage and evaluation as dependent variables

In addition to the analysis of the separate contributions of blockage and evaluation to share, as described in the above examples, it is also practical to separately analyse blockage and evaluative outcomes as dependent variables in their own right. These variables consist of the individual adjustment coefficient arrays for blockage or evaluation, respectively, across the set of options being analysed.

Separate analysis of blockage and evaluation outcomes is useful as the factors generating blockage and those impinging on evaluative outcomes are likely to be very different. They usually require different kinds of explanation and are best handled by considering them separately.

Analytical software

A freeware Excel program is available for performing evaluative and blockage analysis, including analysis of different sources of blockage, and outputting coefficient arrays. (Gardner, 2006)

Conclusions

Using the methods described here it becomes practical to analyse, in an integrated manner, the contribution of blockages, on the one hand, and evaluations, on the other, to selections amongst options. Furthermore, for each type of blockage it is possible to assess both the scale and direction of impacts on shares of selection and how these effects are distributed between options. In addition, the methods provide means by which the different sources of these contributions may be further analysed across samples without the “missing” data attrition commonly attributed to “don’t know” and other reasons for blockage.

Before applying these procedures it is of importance to consider the nature of the selections which respondents are to evaluate, the relevant range of options to be considered, including whether the selection set is to be open or closed, the measurement model to be applied, the range of blockages to be specified and analysed, and the development of questionnaire procedures by which this data can be effectively and efficiently collected.

References

Ajzen, Icek "Nature and operation of attitudes" in Annual Review of Psychology pp27-58, Annual Reviews, 2001

Ajzen, Icek and Martin Fishbein "Understanding attitudes and predicting social behavior" Prentice-Hall, Inc, Inglewood Cliffs, New Jersey, 1980

Bunge, Mario "Causality: the place of the causal principle in modern science" Meridan Books, Cleveland, 1963

East, Robert "Changing consumer behaviour" Cassell, London, 1990

East, Robert "Consumer behaviour: Advances and applications in marketing" Prentice Hall, London, 1997

Fishbein, Martin and Icek Ajzen "Belief, attitude, intention and behavior" Addison Wesley, Reading, Mass 1975

Gardner, Winston, "MaceTech Sabre Analysis", 2006, A freeware Excel program add-in for analysis of evaluation and blockage, available at <http://www.ResearchOnChoice.com> (Accessed 30 December 2006)

Marder, Eric "The laws of choice: predicting customer behavior", 1997, The Free Press, New York

Meager, Nigel, Claire Tyers, Sarah Perryman, Jo Rick and Rebecca Willison, "Awareness, knowledge and exercise of individual employment rights" 2002, (accessed November 24, 2006), [available at: <http://eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED475333>]

Panagakis, Nick "Incumbent Races: Closer Than They Appear" in February 27, 1989 edition of The Polling Report. Available at: <http://www.pollingreport.com/incumbent.htm>

Rosenstone, Steven J., Donald R. Kinder, Warren E. Miller, and the National Election Studies. "National Election Studies, 1996: Pre- and Post-Election Study [dataset]. 3rd release. Ann Arbor, MI: University of Michigan, Center for Political Studies [producer and distributor], 1998. <http://www.umich.edu/~nes>

Vowles, Jack et al "The New Zealand Election Study" Information and data available at: <http://www.nzes.org/exec/show/2002> (Accessed 30 December 2006)