Rationality, Decision Theories, and Thresholds: Implications for Environmental Valuation

by

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Abstract: The purpose of this paper is to promote a discussion about different theories of rationality and models of individual decision making, as well as the role of thresholds in the valuation of environmental management and policy issues. The intent of this paper is to provide some conceptual distinctions between models and theories in order to develop experiments that empirically test one or more of the issues raised herein.

INTRODUCTION

People can and do make decisions and choices everyday. How people arrive at their decisions, or how they choose one outcome over another, is not so straight-forward. Several factors can affect decisions and choices including the complexity of the decision- or choice-problem; how uncertain the outcomes or even people's perceptions of what their own values are; the difficulty of resolving conflicts when they arise in the evaluation stage of the decision or choice process (if these conflicts are resolvable); the strength of people's beliefs and attitudes toward the object of the decision; whether emotional, instinctual, or intuitive responses are invoked; and/or the amount of information people have available to them.

Probably the most widespread paradigm in decision theory, affecting most disciplines in the social sciences but having its greatest expression in neoclassical economics, is the neoclassical utilitarian theory of rationality. The neoclassical model provides both normative and descriptive explanations of real-world decision making. The neoclassical model is primarily a logical empiricist interpretation of the world of decision making, in which all behavior is explained through reference to its deductive, logically defined theory. When observed behavior does not support the theory, the 'anomaly' can be explained away through imperfections in the individual thus leading to a mistake, or that the decision maker is not fully functioning as a 'rational' human being. Tversky (*reference??*) identifies four reasons why observation may not conform to theoretical expectations: 1) incompetence on the part of the decision maker, 2) the elements being compared, of which only one can be chosen, are so similar in value that the decision is difficult or that the decision maker is theoretically indifferent between them; 3) laziness and/or habituated choices on the part of the decision maker which leads to the use of heuristics or rules; and 4) complexity of the decision problem can lead to attribute queuing, or in a sense, simplifying the choice problem through focusing on specific attributes of the elements.

Other models continue to be developed in response to the inability of the neoclassical model to fully explain behavior and real choices, including the systematic violation of one or more of the axioms of rationality. These alternative models of decision making are being developed with a broader understanding and definition of what it is to be human. It is these other models of decision making, and choice strategies employed, that will be the main content of this paper. One of the goals of this paper is to place the neoclassical model in the context of the larger realm of decision making, showing that it is simply another model (albeit a very powerful one) of the way people make decisions. However, it is not adequate nor sufficient in and of itself to explain human behavior over a seemingly infinite number of possible decision problems. In essence, what I will be arguing for is a contextualists' approach to decision modeling, i.e., a method pluralism wherein people are permitted to invoke different strategies and rules given the context of the decision problem.

Complete behavioral modeling of choice includes three components – motivations, rules, and observation (Opaluch and Segerson, 1989). Underlying motivations for behavior provide the origin of decision rules and ultimately observable behavior. Specifying these motivations is the most structural approach to modeling where these specifications can be traced through to actual

behavior. This is the subject of the first part of the paper on alternative conceptions of rationality.

Decision rules for making choices are a means of linking underlying motivations with actual behavior. Specification of decision rules, such as optimizing rules, satisficing rules, rules of thumb, and lexicographic rules, allows the determination of the set of observable behavior that is implied by these rules. Decision rules are the topic of the second part of this paper.

Potentially observable behavior can be used to assess the model and integrate decision rules with observed behavior. It is also useful in predicting behavior. This component to modeling choice will be used in the final part of this paper when discussing a contextualist meta-theory of decision making, and its potential implications for valuation of environmental management and policy.

The structure of this paper is as follows. The neoclassical model will be more fully developed identifying both its axioms of rationality under certainty and uncertainty and its logical assumptions and implications for decision modeling. Following this, several alternative theories of rationality will be presented. Next, several different decision models will be discussed in the context of conflicts, use of information, and comparison of alternatives or options in the decision problem. To wrap-up the discussion of decision theories and models, I will briefly describe a meta-model of decision making that is contextualistic in nature. I will then present a discussion on the role of thresholds in environmental valuation in terms of the different decision models developed previously. This paper will then conclude with a discussion on the implications of all the above for the valuation of environmental management and policy issues.

THEORIES OF RATIONALITY

Instrumental Rationality: The Neoclassical Paradigm

As stated in the introduction, the neoclassical model is being presented as the opposing force in decision theory and modeling insofar as it is the paradigm that has had, and continues to have, the greatest impact on the social sciences. Its greatest expression has been in the realm of neoclassical economics. Lutz and Lux (1988) caution that

> "by teaching that economics is ultimately about the right ('the economic') way of thinking, they [early neoclassical economists] may have had some influence in how we actually now think. In the process, one easily forgets that approaching everything in terms of considering opportunity costs has an opportunity cost of its own: the inability to appreciate actions based on commitment to ecological and social values and moral concerns" (pg. 77).

It is beyond the scope of this paper to provide a detailed description of the theory or to completely develop its framework. Therefore, a skeletal framework of the theory will be developed insofar as it supports the arguments herein. An individual within the neoclassical framework is an 'instrumentally rational and calculating seeker of preference satisfaction" (Heap

et al., 1992, 62). Instrumental rationality requires the ability of individuals to compare levels of satisfaction between competing objectives through measurement on a single scaled utility function. The objective of the instrumentally rational individual is to maximize his/her utility. Under conditions of uncertainty, he/she maximizes his/her expected utility.

Instrumental rationality is closely intertwined with the philosophy of utilitarianism. Typically this means that the individual is a unitary self, i.e., the person is a bundle of unambiguous and stable preferences (March, 1978, 595-596). Thus, through an individual's privy to his/her own preferences, he/she can unambiguously order his/her preferences and maximize his/her utility. However, in order to operationalize the issue of competing preferences, restrictions are placed on his/her preference ordering. This entails four axioms of rationality under certainty. The first three axioms are required for a preference ordering. The fourth axiom is required for the representation of the preference ordering via a utility function. The axioms are reflexivity, completeness, transitivity, and continuity. The underlying utilitarian ethic of the neoclassical rational human is to maximize his/her personal utility. This ethic implies that if all humans follow the same objective, the general welfare will be enhanced.

When an individual can be uncertain as to possible outcomes, or even his/her own values, then the theory requires some known probability distribution over actions and outcomes. This has been developed as the theory of expected utility. Outcomes are now probable and the instrumentally rational individual's main objective is to maximize expected utility. Additional axioms of expected utility are required. The first three (reflexivity, completeness, and transitivity) are still required for a preference ordering. However, additional axioms of expected utility are required for the preference ordering to be represented via an expected utility function. These additional axioms include that preferences increase with probability, continuity, strong independence, and rules for combining probabilities. A full discussion of the axioms of rationality can be found in most intermediate microeconomics textbooks.

A more intuitive understanding of the neoclassical paradigm and its theory of rational choice is available through a discussion of several assumptions and their implications of the theory for decision making. Although these points are numbered, they are obviously interrelated.

1) *Value monism*: The neoclassical paradigm assumes a value monism in the sense that all preferences or values are reducible to a single metric. This assumption also implies that all values are comparable and can be made commensurable. The idea here is that all personal utilities can be placed on a uniform, universal scale, typically, but not necessarily, money. In contrast, a contextualist philosophy like that of John Dewey's argues for a value pluralism. In this case, it is not assumed that all values can be reduced to a single metric and cannot therefore be made commensurable. A values pluralism accepts unresolvable conflicts between value commitments, including moral, political, social, individual (personal), professional, religious, emotional, aesthetic, and economic. To put it another way, the neoclassical paradigm assumes uni-dimensionality of value.

2) *A single meta-utility function*: The neoclassical paradigm assumes that there is a single utility function through which measurements of different preferences can be compared, with a single ordering of preferences implied. This assumption is very similar to the assumption of

value monism in the sense that it is through the utility function and commensurable measurement of preferences that conflicts are resolved. Additional utility functions can be added to the neoclassical model, however this does not prove to be helpful and begs the question to the comparability of these different utility functions. This is why I state the assumption as a meta-utility function. Arrow (1963), Elster (1985), Etzioni (1988), Harsanyi (1955), Levi (1986), Margolis (1982), Sagoff (1988), and Sen (1977) all argue for at least dual utility functions. Several of these authors also present these dual utility functions as separate and irreducible sources of values, i.e., social values cannot be reduced to considerations of personal gain. The separate dual utilities theories rest on the intuition that individuals have two selves – the self-interested one, and the social one. The first is only concerned with individual wants, needs, and desires; the second with the good of the community. The first strives for personal pleasure; the second expresses morality. Each self's preferences place demands on the individual and his/her resources, often resulting in conflicts and inner (moral) struggles. In many cases one's morality places restraints on his/her self-interested maximization of personal pleasure.

3) *Self-interest*: The neoclassical paradigm assumes that the individual makes decisions for his/her own personal benefit, and that individuals are the best judge of what is good for them. This is the assumption of consumer sovereignty that is important for the application of the neoclassical paradigm to social welfare issues. As an extension, the neoclassical paradigm assumes that social welfare is the summation of individual welfare. Although the conception of what is in one's own self-interest can be expanded to include all others, this results in a tautological argument that cannot be refuted. As Sen (1977, pp322) states: "It is possible to define a person's interests in such a way that they either cannot be falsified or are very difficult to refute, thereby constituting complete or near-tautologies." That is, all behavior is maximizing self-seeking pleasure, so when we observe behavior, maximization of pleasure is what is revealed. If self interest is expanded to a universal set of concern including all others, then it is no longer juxtaposed to anything and becomes a non-entity.

4) *The free-standing individual is the decision making unit*: The neoclassical paradigm assumes that the individual is the sole unit of concern in decisions, and that these decisions are made for the sole purpose of self-interest. Consumer sovereignty in this case applies to the market where it is assumed one dollar is equal to one vote. Compare this type of sovereignty with political sovereignty where one person equals one vote, and the imbalance of power in the market becomes apparent. The assumption of the free-standing individual places all power in the hands of the individual as an autonomous, atomistic person. In contrast, humans can be defined as social beings whose decision are made within social contexts and collective constraints. Here the autonomy of the individual is seen as his/her ability to freely choose within his/her social and cultural constraints. The individual is a function of his/her historical, social, and cultural environments, not some collection of random and independent elements.

5) *Values and preferences are unambiguous and stable*: The neoclassical paradigm assumes that the individual knows his/her preferences and values and that they are stable, i.e., preference expressions are invariant to context changes. Two forms of invariance are implied by the neoclassical framework. Preferences should be invariant to how the options are described (description invariance) or how preferences are elicited (procedural invariance).

Much evidence has been obtained empirically to refute this assumption. Tversky, Kahneman, Slovic, Lichtenstein, and Fischhoff, among others, have shown that preferences are sensitive to framing effects (descriptive variance) and to the response mode (procedural variance). Thus, there is evidence that preferences are constructed, and not merely revealed, in the elicitation process. Additional evidence to the construction of preferences is found in the literature on preference reversals (Slovic and Lichtenstein, 1983), the Allais paradox, and the Ellsberg paradox, all of which have been repeatedly produced in laboratory settings. These issues have given rise to theories and hypotheses such as prospect theory (Kahneman and Tversky, 1979) framing effects (Tversky and Kahneman, 1986), and prominence effects (Tversky et al., 1988), among others.

6) *Marginality*: The axioms of continuity in the theory of rational choice under certainty and uncertainty imply that all goods are infinitesimally divisible and tradable, in turn implying that no goods are necessary. This rules out lexicographic preferences and thresholds over levels of goods. It also rules out a hierarchical ordering of preferences, treating each level as infinitely divisible by any other (see Maslow (1968, 1987) for a discussion of a hierarchy). Several arguments against this axiom revolve around the reality of potential sources of lexicographic preferences such as basic needs and moral and religious principles or maxims (Crowards (1997), Encarnacion (1992), Georgescu-Roegen (1954), Rawls (1971), Spash and Hanley (1995), Stevens et al. (1991), Stork and Viaene (1992)).

7) *Utilitarian ethic:* While there are many forms of utilitarian philosophy and not all are hedonistic and self-centered, the utilitarian philosophy upon which the neoclassical paradigm rests is both (Etzioni, 1988). This ethic states that all that matters when determining the good or bad of an action is solely its outcome, or consequences. Therefore, the acts themselves are amoral. In addition, this ethic implies that by each self-serving individual maximizing his/her own self-seeking pleasure, the general welfare is enhanced in the process. A competing ethic arises in the deontological philosophy of ethics. Immanual Kant is probably the most well-known proponent of this ethical view. The deontological ethic judges actions, intentions, and urges themselves as morally good or bad. This implies that regardless of what the subsequent outcomes or consequences of actions are, actions themselves should never be pursued if they are morally wrong. Thus, the deontological ethic promotes the concepts of rights, obligations and duties in the context of collectives or communities. The autonomy of the individual is exemplified, under the principles of deontological ethics, as having self-command over ones urges and desires, fighting a battle or struggling between moral or value commitments and self-serving immediate pleasure (Schelling, 1984).

8) *Free from cardinal conflict*: The axioms of rationality, or more specifically those that ensure a preference ordering and continuity, result in a single utility function that is scalable for all monotonic transformations. This directly implies that there will be no cardinal nor ordinal conflict in an individual's preferences. Cardinal conflict arises when options or outcomes can have more than one measure. A single utility function negates this possibility, along with assumptions of unambiguous and stable preferences. Ordinal conflict is when available options or outcomes, amongst which one of them is chosen to maximize the chooser's utility, more than one ranking of the options exists. While the utility function is order and scale preserving, thus not necessarily requiring cardinal measures, the axioms do require, for purposes of measurement and utility calculation, that it be free from cardinal conflict. And

being free from cardinal conflict implies that it is also free from ordinal conflict since monotonic transformations of the utility function (free from cardinal conflict) is a subset of linear or affine transformations of the utility function (free from ordinal conflict). The axioms of reflexivity, completeness, and transitivity negate preference or value conflicts. And taking this argument one step further, no conflict implies that there are no real choices in neoclassical models. That is, utility maximization is performing arithmetic and not choosing based on conflict. "Real choice is qualitative, not quantitative" (Lutz and Lux, 1988, pg. 126).

9) *Decisions are solely cognitively based*: The individual in the neoclassical paradigm is an instrumentally rational and calculating seeker of preferences, as stated earlier. This means that the individual, in his/her decision making, is unaffected by emotions, intuitions, instinctual responses, habits, and morality (beyond the utilitarian ethic). Individuals measure their own level of preference satisfaction from all the possibilities arising from their own actions, calculating which action will maximize own utility, and choosing the maximizing option that is in their own best interest without regard to others. Empirically, examples are numerous that refute this assumption. People continually make personal sacrifices for the sake of others, react emotionally, make snap judgments, utilize rules in decision making, and choose based on 'gut' reactions.

10) *Value is equal to willingness to pay:* Possibly the most inequitable assumption of the neoclassical paradigm is the equivalence of 'value' with willingness to pay. The spirit within which the notion of willingness to pay is promoted is really no different from ability to pay. Ability to pay is the effective constraint on the economic valuation of goods and services, or the amount of money or other tradable possessions one 'sacrifices' for the satisfaction or pleasure being purchased. The logical conclusion then is that people with no money or few possessions have zero willingness to pay and therefore nothing has any value to them. This constraint to economic valuation is morally debilitating, presumptuous, and prejudicial.

The above list of implications and assumptions exemplifies problems that people may have with the neoclassical model, in its most strict interpretation. While many of the issues above overlap and are intertwined, each has been used as a focal point in criticisms of the model. On a more general level, the neoclassical conception of humans as individualistic, instrumentally rational seekers of self-serving pleasure, is a good area to differentiate other models of rationality. The following will briefly present other conceptions of humans, resulting in different models of rationality.

Procedural Rationality

One major movement away from the concept of humans as rational calculating machines began with the work of Herbert Simon. Simon (1959) argued that humans, because of their inherent cognitive limitations, could not realistically perform the tasks the neoclassical model of instrumental rationality demanded of them. Instead, humans reduced the complexity of the problem by using simplifying rules. And instead of maximizing utility, they used satisficing behavior, striving toward attainable aspiration levels. The use of rules of thumb can be interpreted as a variation on the neoclassical model where the rules and aspiration levels can

enter as constraints to the utility maximization problem. Thus the overall optimal solution is not necessarily obtained nor known, but instead some aspiration level, or minimum level of satisfaction is pursued. Two interpretations of Simon's work have evolved, each being more fully discussed in the next section. One interpretation is that even with the inherent limitations to human cognition, people still act instrumentally rational, striving to come as close to maximizing utility as each person's skills and abilities permit.

The other interpretation argues that it would be an injustice to interpret the entire procedural rationality movement as a variation on the neoclassical model. Structurally, this movement is also fundamentally different from the neoclassical model, especially in the sense of humans being individualistic self-seekers. The rules themselves can arise from and take on a social context, such as laws, norms, and ethical and religious codes. These rules represent shared values and beliefs by members of the community and can greatly affect how and what people choose. Belonging to a community, a sense of place or attachment, and emotional connections drive decisions as much as purely cognitive notions do. And, more importantly, people choose not strictly out of their sense of self-interest, but also because of their sense of belonging. Thus, humans are not only individuals competing for what is in their own self-interest, but also social beings with cultural, social, community, and group constraints and attachments. A person's historical, institutional, cultural, and religious environments affect and are affected by his/her choices. Rules are typically invoked to resolve, or at least circumvent, conflicts in values.

Models that build off of a conception of procedural rationality are accounted for in the works of Simon's (1959) bounded rationality and satisficing behavior, Georgescu-Roegen's (1954) lexicographic preferences, in part Etzioni's (1988) I&We paradigm, Sagoff's (1988) consumer-citizen dichotomy, and Tversky's (1972) elimination-by-aspects theory.

Expressive Rationality

Expressive rationality is another concept of rationality that has been developed. It builds on the notion that humans do not just pursue pre-existing goals based on fixed values, but have the ability to define or shape these goals and underlying values through their choices. Actions are not treated merely as means to some goal, but can be treated as ends in themselves. Expressively rational people not only use creativity and judgment to determine what values they feel they should have, but also how they can use these values to shape the person they want to be. Normative-affective factors, such as values, emotions, morality, and community, determine what their decisions and choices will be. Conflicts can also persist, since value commitments in the different factors of decision making are not only present, but can be shaped by one's creative choices.

Thus, in expressive rationality, people are "as much concerned with establishing the value of ends pursued; and that action is as much an expression of those beliefs regarding value as it is the execution of a plan to satisfy given objectives" (Heap et al., 1992, pp 21-22). Models of people choosing in a creative manner can be found in Kant's (1788) 'deontological ethics', Weber's (1922) 'value-rational', Habermas' (1985) 'communicative action', Elster's (1985) 'broad notion

of rationality', Maslow's (1968, 1987) 'self-actualization', and Etzioni's (1988) 'I&We paradigm'.

Non-cognitive Motivations

In addition to the highly cognition-dependent conceptions of rationality, I feel it is important to add the concept of non-cognitive motivations. This concept deals with the role of emotions, intuitions, and instincts in decision making. While emotions, intuitions, and instincts can permeate the procedural and more directly, the expressive notions of rationality, it is important to directly draw attention to their role in decision making. Many times emotive and instinctual responses lead to the best outcome as determined by later cognitive reflection. For example, if the house is on fire, the impulse is to run to safety, not cognitively deliberate the options available given the situation. Upon cognitive reflection it may be found to have been the best option to take, but at the time, it was an instantaneous response to the situation at hand. The literature on the role of emotions and intuitive judgments is as diverse as the rest of the content of this paper. I do not intend to leave the impression that there is one role or interpretation of the role(s) of emotions, intuitions, and instincts. However, the complexity of this literature goes well beyond the scope of this paper and is not reviewed here. Etizioni (1988) believes non-cognitive factors affect the majority of decisions, with instrumental rationality occurring only under unique circumstances.

Several categories of value that one may be committed to may only be appreciated on a non-cognitive level, such as aesthetic and religious values. In other situations, a decision may be made along some continuum of cognition/affectation such as in Abelson's (1976) "hot" and "cold" cognitions. Margolis (1982) has developed a theory of altruistic behavior based on a view that humans have evolved as social beings, and as such, instinctively respond altruistically to situations within social contexts. Therefore, this conception of non-cognitive motivations is included here to capture the principle that (taking liberty with the title of Zajonc's (1980) essay) preferences and values, as motivations for decisions, need no inferences. Responses based on habituation and tradition are also included in this concept, since no cognitive effort is invoked when making a choice.

Jung (1957, 1959) does well to express the spiritual and instinctual side of human beings through his work on archetypes and the collective unconscious. According to Jung (1959), the collective unconscious is a "common psychic substrate of a suprapersonal nature" (pg. 4). Its "contents and modes of behavior are more or less the same everywhere and in all individuals" (1959, pg. 4). In another of his works, Jung (1957) argues that cognition or conscious effort is not sufficient in itself to decision making. He also believes that cognitive effort is only needed for those instances when intuition and feeling do not suffice.

> "But even though the first step along the road to a momentous invention may be
> the outcome of a conscious decision, here, as everywhere, the spontaneous idea –
> the hunch or intuition – plays an important part. In other words, the unconscious
> collaborates too and often makes decisive contributions. So it is not the conscious
> effort alone that is responsible for the result; somewhere or other the unconscious,

with its barely discernible goals and intentions, has its finger in the pie" (Jung, 1957, pg. 111-12).

A final note on concepts of rationality concerns the role of motivations in decision making. Each of the alternative conceptions of rationality and their subsequently evolving models weaken one or more of the very strong assumptions in instrumental rationality. Most of the changes to, or wholesale replacement or rejection of, some of the instrumentally rational assumptions of the neoclassical model in the alternative conceptions come at a price. The models based on alternative theories of rationality are not as stringently modeled mathematically, are more difficult to quantify, and because of their relativistic interpretation of human behavior, are less capable of predicting future choices. However, where these alternative models do provide insight into the complex world of human decision making is through their introduction of empirically and intuitively relevant factors that can motivate decisions. In addition to the neoclassical motivating factor of maximizing personal utility, these alternative theories have included the utility of others separate from one's own, a individual's morality, institutional support, social contexts, religion, emotions, intuitions, habits, instincts, deeper visions of the role of values and value commitments, and the shaping of one's self and his/her surrounding social and institutional environments.

Because the decision process can become complex and messy, many conflicts can arise in everyday decision making. These conflicts are the result of different demands on our attention and allocation of resources, and may provide us with multiple objectives and options from which to choose. In many cases, we can only choose one out of a myriad of possibilities, with many options and future opportunities dependent upon what and how we choose today. Therefore, in light of the complexity of decision making and conflict resolution, we may need to employ different strategies. The following is a brief review of some of the more prominent decision strategies that have been developed. Each rests on a different conception of what it is to act rationally. Each can treat conflicts differently. And each can use the available contextual information in different manners and to varying degrees.

DECISION STRATEGIES

Decision strategies can be categorized by how they approach conflicts, use or process information, or deal with other issues in decision making such as complexity and uncertainty. Decision strategies involve some level of conscious effort on the part of the decision maker, and therefore may not encompass non-cognitive factors, especially instinctual ones. Hogarth (1987) categorizes decision strategies by how they deal with conflicts. Compensatory strategies or models are conflict confronting, i.e., they allow the trading-off of a low value on one dimension with a high value on another dimension. Non-compensatory strategies are conflict avoiding, i.e., they do not allow trade-offs.

It is not apparent, at least to me, how compensatory strategies 'confront conflicts', while non-compensatory strategies 'avoid conflicts'. The best intuitive explanation I can come up with is that compensatory strategies allow infinitesimal trade-offs between dimensions across alternatives, and that these strategies, implicitly at least, simultaneously compare alternatives.

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Non-compensatory strategies, on the other hand, use some sort of sequential evaluation of each alternative, more-or-less independent of the other alternatives available.

Nonetheless, conflict is a necessary condition for choosing or making decisions. A conflict is when more than one alternative or option is available, but only one can be chosen. Therefore, any evaluation, whether it be compensatory or non-compensatory, must deal with the conflict in some fashion. While not all conflicts may be resolvable, a choice must be made. Non-compensatory strategies may be easier in the sense that they do not rely on the full use of all the information available. That is, non-compensatory strategies use some form of a rule of thumb in making decisions involving multiple alternatives with multiple attributes, whereas compensatory strategies rely on the quantification of information on each attribute, and some form of calculation to decide which alternative is best. Therefore, I prefer delineating the models based on their use of existing information and how they compare alternatives. That is, whether the models use information and compare alternatives simultaneously or sequentially.

Assumptions about the process by which people arrive at decisions classifies models into two categories – simultaneous processing of information (compensatory strategies) or sequential processing of information (non-compensatory strategies). Models that assume simultaneous processing include *the linear model, the additive difference model, the ideal point model, and a weak form of satisficing*, all of which can be forms of utility maximization and instrumental rationality. Simultaneous models use an optimizing process to decision making, simultaneously using all or a portion of the information available. Models that assume sequential processing include *conjunctive models, disjunctive models, strong satisficing, lexicographic processes, elimination-by-aspects,* and *Maslovian theory of hierarchical motivations*. These sequential models are based on procedural and/or expressive rationality Sequential models use a discriminal process to decision making, sequentially using specific information to discriminate alternatives in a systematic fashion. (A note to the figures – each step in the figures that accompany each model can be iterative. Each option comprises multi-attributes.)

Simultaneous or Compensatory Models

In the *linear dimension model* "it is assumed that each dimension can be measured on a scale and given a weight reflecting its relative importance. The evaluation of each alternative is then the sum of the weighted values on the dimensions" (Hogarth, 1987, pp 73). The choice is the for the alternative with the greatest value (see Figure 1).

Whereas the previous model evaluates each alternative independently of the others, the *additive difference model* compares the alternatives dimension by dimension prior to some aggregate evaluation. "In this strategy, the decision maker is assumed to evaluate the differences between the two alternatives on a dimension by dimension basis, and then to aggregate the differences to see which of the alternatives is favored by the aggregate net difference" (Hogarth, 1987, pp74).

The *ideal point model* is similar to the aggregate difference model, except that in this model, the decision maker "has an ideal representation of what the 'perfect' (i.e., ideal) alternative would be" (Hogarth, 1987, pp 75), and then evaluates each alternative by its distance from the ideal

point on each dimension. The alternative chosen is the one that scores the lowest, or is closest, to the ideal. Each of these compensatory models directly confront conflicts by comparing the worth of each on some commensurable scale.

Krosnick et al. (1996) define satisficing via four stages people use to answer questions in surveys.

> "Respondents must carefully interpret the meaning of each question, search their memories extensively for all relevant information, integrate that information carefully into summary judgments, and respond in ways that convey those judgments' meanings as clearly and precisely as possible.
>
> *Satisficing* involves compromising one or more of these steps, and it can be conceived of as taking two forms: weak and strong. *Weak satisficing* entails executing all four of the stages just as described, but being less than thorough in doing so… *Strong satisficing* involves omitting the retrieval and judgment steps from the response process altogether. That is, respondent may interpret each question only superficially and select what they believe will *appear* to the interviewer and/or researcher to be a reasonable answer …(using) cues in the question itself to identify a response that seems easily defensible with little thought." (p31).

Krosnick et al. (1996) continue by proposing three factors that will increase the likelihood that a respondent will satisfice: 1) difficulty of the task, 2) ability of the respondent to perform the required task, and 3) the respondent's motivation to perform the task.

Witteloostuijn (1988) argues that utility maximization and weak satisficing are equivalent decision rules rather than opposite principles. This is because both approaches permit the introduction of uncertainty and routines. It is the 'weak' form of satisficing that is included as a simultaneous processing or compensatory model.

Weak satisficing arises from the work of Herbert Simon. Simon (1959) argues that due to people's inherent information gathering and processing limitations, maximization is not possible. Therefore, people set aspiration levels, such as minimum necessary level of profits, and choose alternatives or options that meet this aspiration. The next time a similar situation arises, the decision maker may 'raise the bar' by increasing the aspiration level. Over time, weak satisficing may converge with the optimal solution to the problem, e.g., maximization of profits. In this way, decision makers expend only the amount of effort necessary to make satisfactory or acceptable decisions (see Figure 2).

The common factor for all of the above models is the assumption that all dimensions are comparable and can be made commensurable, implying tradability between levels of a dimension and across different dimensions.

Sequential or Non-compensatory Strategies

Non-compensatory strategies identified by Hogarth (1987) include the conjunctive model, the disjunctive model, the lexicographic model, and the elimination-by-aspects (EBA) model. I include a strong form of satisficing as being relevant here. As a variation on the lexicographic scheme, I also add a Maslovian theory of hierarchical motivations. These models all use rules of thumb in choosing among available alternatives or options. Sequential information processing models argue that people use structured, sequential factors, in their search for a decision under complexity. Each step in a sequential model can be interpreted to be a definable threshold. These thresholds can lead to simple binary choices by dichotomizing the question into the presence or absence of an aspect, to more complex processing of multiple aspects, implicitly trading several of these in the decision process. Final outcomes in a sequential decision process may be path-dependent.

A *strong form of satisficing* is when a decision maker does not expend all the effort necessary to maximize under the constraints of inherent cognitive abilities, but uses 'rules of thumb' when deciding on which alternative or option to choose. This strong form of satisficing is different from the weak form presented as a simultaneous processing model in that the search process is truncated at the point when an alternative is found which meets the requirements set by the aspiration level. Therefore, another alternative may be available which would more efficiently meet the aspiration level, or more greatly exceed the aspiration level, than the first option found that is satisfactory. In this case, the rule is not constrained maximization, but merely meeting the aspiration level. This is why this form of satisficing is strong and belongs in the class of sequential strategies.

In the *conjunctive model*, "the decision maker sets certain cut-off points on the dimensions such that any alternative that falls below a cut-off is eliminated" (Hogarth, 1987, pp 76). The conjunctive model is similar to a satisficing model.

In the *disjunctive model*, the "decision maker will permit a low score on a dimension provided there is a very high score on one of the other dimensions" (Hogarth, 1987, pp 76). This strategy allows alternatives which are very good on one dimension to remain as admissible options in the decision problem.

The *lexicographic model* involves the use of a lexicographic ordering of the importance of each dimension. The decision maker's first action is to compare alternatives based solely on the most important dimension. If more than one alternative is still admissible, then the remaining alternatives are compared by the next most important dimension, and so on. If the alternatives are compared in a pairwise fashion, the lexicographic rule can lead to intransitivities in choice since the order of the lexicographic rules may not reflect the decision maker's preferences.

Therefore, lexicographic models identify specific, well-defined factors that are important to a decision. All alternatives are sequentially compared based on a fixed order of these factors. Each rule, or factor, in the lexicon can be very different. Some rules are binary in nature; either the alternative has it or it doesn't. Other rules can be based on the logical primacy of a step before a subordinate or secondary step can be taken. For example, an individual may decide to parcel his/her budget between personal expenditures and charitable contributions, and then

allocate his/her charitable contributions budget on a first-come, first-serve basis (Margolis, 1982). Lexicographically, the allocation of a fixed-amount of money comes prior to any decision to donate a specific amount to a specific cause (see figure 3 with a fixed ordering of attributes).

There also may be specific features of a thing or a choice situation that are lexicographically determined before any final decision is made. For example, in purchasing a new pair of shoes, lexicographic thresholds may be defined such as price, then quality, then comfort, then aesthetics. With each subsequent step, the individual pares the set of possibilities (his choice set) down to a manageable size. Instead of comparing all possible satisfactory elements, he/she narrows his/her search to a subset of all possibilities based on some lexicographic ordering of important attributes. As another example, a decision maker holding deontological ethical views that are triggered in a choice situation may reject all alternatives that are incompatible with these views.

In the *elimination-by-aspects model*, it is assumed "that alternatives consist of a set of aspects or characteristics. At each stage of the process, an aspect, i.e., dimension, is selected according to a probabilistic scheme (based on the presence of aspects among the remaining alternatives) and alternatives that do not include the aspect are eliminated" (Hogarth, 1987, pp. 78). Tversky defines an 'aspect' as representative of "values along some fixed quantitative or qualitative dimension (e.g., price, quality, comfort), or they could be arbitrary features of the alternatives that do not fit into any simple dimensional structure" (Tversky, 1972, pp285). In Tversky's (1972) words:

> "Suppose that each alternative consists of a set of aspects of characteristics, and that at every stage of the process, an aspect is selected (from those included in the available alternatives) with probability that is proportional to its weight. The selection of an aspect eliminates all the alternatives that do not include the selected aspect, and the process continues until a single alternative remains." (pp284)

This decision rule is closely related to the lexicographic model, where an ordering of the relevant attributes is specified a priori. Elimination by aspects differs from the lexicographic model in that there is no fixed prior ordering of aspects assumed. The process in elimination-by-aspects is inherently probabilistic (see Figure 3).

Maslow's theory of hierarchical motivations is another variant of sequential models. Maslow (1968, 1987) argued that fulfilling a set of needs, arranged hierarchically from the lowest, most basic needs (physiological) to the highest, least basic needs of self-fulfillment, is what continually motivates people's decisions. Intermediate needs levels, from more basic to less basic are safety needs, belongingness needs, and esteem needs. To a certain extent, the most basic needs must be fulfilled to a minimum level before the next higher needs are evident.

Maslow's three key assumptions include 1) only unsatisfied needs motivate behavior, 2) needs are arranged in a hierarchy, and 3) lowest needs are satisfied first, then the next highest, and so on. In his later work, he believed step 3 to be less tenable, permitting simultaneous growth

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without conflict (Maslow, 1987). That is, he proposed a dual self theory comprised of a higher self and a lower self which are sumultaneously manifested in each individual. Therefore, it is not necessary for an individual to have completely satisfied or fulfilled a lower self need for personal higher self growth to occur. Therefore, alternatives are evaluated based on their ability to assist us in fulfilling these needs. Only those outcomes that satisfy or do not threaten lower level needs are judged acceptable (see Figure 4).

In this sense, a Maslovian hierarchy is compatible with lexicographic orderings. Where it differs from lexicographies is the deepness of the factors invoked in assessing alternatives, and dealing with alternatives that are all contained on a single need level. The first point being that here we are talking about nontrivial things. Trivial aspects that separate one alternative from another are of no consequence in this model. For example, if there were three alternatives, each of which does not threaten a lower need, nor promote a higher need, we would have to invoke some other rules for comparing, assessing, or choosing which alternative is preferred (if we assume away the most extreme case of equivalence between the alternatives leading to indifference about any one with regards to the others).

A Hybrid Sequential-Simultaneous Model

There is the possibility of a hybrid model, one that does not draw as distinct a dividing line between sequential processing of information and simultaneous processing of information. Perhaps this is the model that Simon was thinking about. The hybrid model would state that people would like to maximize, but are aware of their limitations and/or are not willing to expend the required amount of effort for maximizing. Therefore, they invoke simplifying rules to reduce the decision problem down to one that they feel comfortable with. This does not mean that they set a target which upon reaching they are satisfied and terminate their search. What it does mean is that people have to reduce the domain of possibilities in complex decisions in order to come up with a meaningful solution or make a choice. This is the 'weak satisficing' of the Krosnick et al. (1996) definition (see Figure 5).

Kauffman (1990) expands the theory of bounded rationality and satisficing behavior in firms' decisions by incorporating Maslow' theory of motivation. Arguments against satisficing behavior in firms is that in the long-run, these firms will not survive in a perfectly competitive market. This is because they do not profit maximize and are therefore always at a disadvantage in the market. Also, there are no incentives or motivations to continue to search under the theory of satisficing. However, if Maslow's hierarchy of motivations is included, then the incentives and long-term viability of satisficing firms becomes apparent. In this case, the firm first determines its minimum level of profit needed in order to remain in business. Once this is sustained, then the firm determines its minimum level of profits necessary to remain in business over the long-term; i.e., its survival need. Additional needs in the hierarchy of the firm are developed as the firm grows and matures. These higher level needs are not considered in the initial decisions because of the lexicographic order of lower needs satisfaction prior to considering higher level needs.

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Therefore, we may propose that a model of consumer behavior can likewise be expanded to include what we have learned about simultaneous models and sequential models. A hybrid model can be developed that allows a consumer to invoke any of the rules or behave in the manner defined by each of the models given the situation and conditions of making a decision. However, there seems to be a logical ordering, or hierarchy of power, entailed in each of the different models above. This means that some of the rules or implementation of the rules in the different models logically have more strength or are more stringent in implementation.

A potential hybrid model could include the following steps:

1) Evaluate all alternatives on their ability to promote the attainment of a given level of needs-fulfillment, eliminating those that threaten a lower need and those that do not promote a higher need in the presence of an alternative that does. If none of the alternatives promote a higher need nor threaten a lower need, then all are accepted and we proceed to step 2.

2) Evaluate all remaining alternatives based on other aspects, if the choice set is still too large to handle easily, eliminate those that do not have the necessary feature.

3) Evaluate the remaining alternatives simultaneously based on some value function and choose the one that optimizes utility given the relevant constraints.

An example is given in figure 6.

A META-MODEL OF DECISION STRATEGIES

So far we have reviewed different concepts of rationality – instrumental, procedural, expressive, and non-cognitive – along with several different decision strategies – simultaneous or compensatory, and sequential or non-compensatory. But how do these supposedly competing views all fit together? The answer may be in an extension of John Dewey's contextualist view that results in the argument for a value pluralism (Levi, 1986). This extension is to apply the contextualist's view to decision making models and strategies, i.e., a meta-model that accepts each concept of rationality and its implications for decision making as admissible in the realm of conflict resolution. Under different circumstances or decision situations, with different problems and levels of information available, a pragmatic approach for the decision maker would be to use any of the tools available to him/her.

For example, when the decision problem is strictly related to market involvement, say the purchase of personal goods, the decision maker may be fully confident in his/her ability to use all of the information available to simultaneously compare his/her options, and choose the option that will maximize his/her personal utility. In cases of moral conflict, sequential strategies may be invoked. As Weber (1922) states:

> Social action, like all action, may be oriented in four ways. It may be:
> 1) Instrumentally rational, that is, determined by expectations as to the behavior of objects in the environment and of other human beings; these expectations are used as 'conditions' or 'means' for the attainment of the actor's own rationally pursued and calculated ends;

2) Value-rational, that is, determined by a conscious belief in the value for its own sake of some ethical, aesthetic, religious, or other form of behavior, independently of its prospects of success;

3) Affectual, that is, determined by the actor's specific affects and feeling states;

4) Traditional, that is, determined by ingrained habituation (pp 24-25).

In a contextualists' meta-theory, the decision maker must make choices on two levels. The first level is to determine which values or preferences and value commitments are admissible in the decision process. On the second level, the decision maker must determine which decision strategies are permissible to use in resolving the conflict. In addition, it should be noted that when conflicts are in the first level of the decision problem, they may not be resolvable, i.e., conflicts between value commitments including moral, social, political, economic, personal, religious, institutional, and aesthetic values. For a theory of decision making under unresolved conflict, see Levi (1986).

Thus, a contextualist's meta-model of decision making would be descriptive in nature, i.e., inductively being built upon what people do, and not prescriptive (normative), i.e., deductively built on axioms of what people should do. Complexity would be accepted under this theory in the sense that people are 'reasonable' under all concepts of rationality, and that decision making cannot be reduced to a single objective such as utility maximization. Choice situations that involve difficult or 'hard' decisions are those in which commitments to the different factors of value conflict. That is, when values and preferences lead to conflicting or contradictory commitments as expressed in one's inconsistency in choices and judgments.

If the contextualist's theory of decision making is accepted, then several questions need answered. Under what conditions are the different models applicable or appropriate, and how do we detect and measure them? Within what contexts do people's values conflict, and how are these conflicts resolved? Which categories of values more frequently lead to conflicts in value commitments? Under what conditions do people express social judgments with their choices as compared to choices for their personal satisfaction? Is there a hierarchy of value commitments that enable people to resolve conflicts between these commitments when they arise? And, as the subject of the next section, do people have thresholds for value commitments, and if so, what is the role of thresholds in decision making?

THE ROLE OF THRESHOLDS IN DECISION STRATEGIES

Definition

To begin with, a threshold is defined here as a point or level that divides a region or thing based on certain criteria. Thresholds can be objective, i.e., they are assumed to be value-neutral or fact-based distinctions. For example, objective thresholds are minimum viable population size for species survival, perceptual contrasts to differentiate colors, or optimal distance between the neighborhood and schools or main arteries of transportation (Peterson and Worrall, 1970; deBettencourt and Peterson, 1976, 1977, 1981). Or thresholds can be normative, i.e., they are

value judgments about a thing, and divide a region into acceptable versus unacceptable outcomes, or satisfactory versus unsatisfactory outcomes, and may be based on social principles, rules, codes, norms, and ethical, religious, and cultural beliefs. For example, normative thresholds are policy standards and regulations, customs, and etiquette. Our primary concern here will be with normative thresholds. However, people's beliefs about objective thresholds can affect their decisions or opinions about management and policy.

Levels of Application

Normative thresholds can be identified on three application levels. First, there are policy or regulatory applications of thresholds. These typically set minimum standards below which an outcome is judged as unacceptable. Examples include noise and air quality standards. These policies and regulations do not promote ideal outcomes, but place limitations on the acceptable level of certain outcomes. Ideal outcomes require full-information and foresight, which is not realistic.

Second, there are consumer applications of thresholds. These applications are individual specific and rely on the individual's conception of what is 'best' in his/her own self-interest. These thresholds define, for the individual, the maximum or minimum level of an outcome that would no longer be acceptable.

And third, there are citizen applications of thresholds. These applications are individual specific to the extent that the thresholds reside in the context of a person's perceptions, and that these thresholds affect his/her actions. Citizen applications of thresholds, however, are distinctly separate from consumer thresholds to the degree that these thresholds are expressions of good and bad for a group – family, community, institution, nation, or society. Citizen thresholds are expression in the group-interest that can at times be conflicting with consumer-defined thresholds. Since our primary interest here is in individual behavior, each application level of thresholds is included insofar as each of these applications affect individual decision making behavior.

Types of Thresholds

Thresholds can be well-defined or fuzzy. This distinction is similar to the concept of narrow versus fat indifference curves. Well-defined or narrow thresholds should be easily identified since they are unambiguous and stable delineations between acceptable and unacceptable outcomes. An example is the refusal to sacrifice a single life, no matter the consequences (see Figures 7 and 9).

Fuzzy or fat thresholds are less well-defined. They can comprise areas between acceptable and unacceptable outcomes where the judgment is less certain. Outcomes that fall within a fuzzy threshold region are ambiguous and sensitive to context (see Figures 8 and 10). Because they are ambiguous and context dependent, they can lead to intransitivities in observed choices.

For example, several different responses can be obtained from different people in a survey. Assuming away any survey design problems, consider a hypothetical case involving old-growth forests. There is a fixed amount of old-growth remaining in the United States. Controversies surrounding the continued harvest of old-growth from public lands have been widely publicized. A survey is conducted to assess people's value for protecting old-growth using a hypothetical situation that will reduce the total acreage of old-growth. What are some of the different responses that might be obtained in such a survey? I can think of four distinct ones.

1) Certain people may feel that their critical threshold of minimum viable amount of old-growth forest has already been surpassed (or violated). In this case, these individuals will reject any trade-offs involved in the destruction of more old-growth, and prefer more than currently exists. Their preferences may be expressed as extreme bi-modal responses (extremely high or low values - "protest bids"), or non-response.

2) Other people may feel that the existing quantity of old-growth is at or near their perceived threshold and that decreases in the resource are threatening this threshold. These individuals may express large positive values for incremental quantities of the resource, but are still willing to trade-off some amount of old-growth if the gain (or loss) in the alternative is non-trivial.

3) Other people may feel there is plenty of old-growth at the current time. They have an implicit threshold, but this threshold is not being threatened in any way by the hypothetical changes involved in the survey. These individuals would be willing to trade-off quantities of old-growth for fairly trivial advantages, especially as the issues are interpreted in light of their own self-interest. (If an individual expresses preferences for society or a particular group, then they may be invoking a different threshold.)

4) And finally, there may be some people who do not have positive values for old-growth. In this case, they will either not respond to the survey because they don't care about the issue raised in the questionnaire or they may register a zero-value for old growth. These people do not have a threshold, neither explicitly nor implicitly defined.

Therefore, it is prudent to define three levels of thresholds based on their relative strength or ability to motivate decisions.

Three Levels of Thresholds

The three-tiered thresholds system is similar to two-tiered values theories (Etzioni, 1988; Leopold, 1966; Page, 1991; Rawls, 1971) in which the first value tier is an abstraction to principles of justice, fairness, morality, community, or value commitments (similar to a communitarian philosophy). In the second tier, issues of individuated concern are important (similar to a libertarian philosophy). At each subsequent level of consideration, the thresholds become fuzzier and the use of available information in making a choice becomes broader. For example, a first level question is whether any alternatives violate some strongly held moral principles; a second level question is which alternatives do not violate or at least meet some value level or aspiration. The third level then attempts to choose an alternative from all admissible alternatives which are indifferent to first and second level considerations.

The first level in a two-tiered value theory and the first level in the three-tiered thresholds system defines what is right, good, or just, for a society or community as a whole, without reference to known individuals (similar to Rawls (1971) 'veil of ignorance' and 'original position'). It is this first level which defines and allows individuals in the second level to emerge (Etzioni, 1988). For Maslow (1987), this is the tier of the higher self. The first level contains the constraints, contexts, or environment of community which helps shape who we are. Issues in this first level are primary to a decision; it is the first process in determining which alternatives are admissible for further consideration via second level strategies. Decisions at the first level determine which alternatives do not violate any principles, and therefore label alternatives as 'acceptable' or 'not acceptable'. Any alternative determined to be 'not acceptable' is excluded from further consideration.

The second level permits individualistic preferences and values, including expressions of altruism and group concern, to emerge, but always within the constraints or confines of the first tier. However, since the first tier arises from individuals, we must allow for the individual to be able to affect and shape the environment that makes up the first tier. Thus, there is an information feedback from individual values which affect and help shape first tier principles. It is the possibility of conflict between second tier values and first tier value commitments that makes the development or evolution of self and community to be fertile. Any of the decision strategies discussed above may be invoked for issues relating to second level considerations.

The third level in the three tiered thresholds system is included to allow for indifference between outcomes. Alternatives which remain after first and second level considerations may be decided or chosen based on commensurability and quantification. The previous two tiers entail qualitative decisions. This level is the "legitimate indifference zone" of Etzioni (1988). Alternatives that reach this level are indifferent from normative-affective and value commitment perspectives. That is, no first and second level thresholds are violated in the surviving alternatives.

For example, according to Georgescu-Roegen (1954), the reason somebody choose a particular house is because "it offered a nice location for a birdhouse" (pg. 518). This reason is a level 3 factor. Prior to this factor becoming decisive to home selection were the level 1 factors such as a need for shelter of a certain quality and location that is affordable, and level 2 factors such as a preference for the style of house (ranch, tri-level), number of rooms, and color of siding. However, if more than one house is acceptable based on level 1 and level 2 considerations, then a relatively trivial factor, such as the birdhouse above, may be the deciding factor. To summarize, first level decisions deal with needs (moral, social, individual), second level decisions deal with wants and desires, and third level decisions deal with indifferences and commensurability of elements.

Threshold levels or tiers can be further defined as: 1) *have to's*, 2) *want to's*, and 3) *indifferent to's*. The overarching objective function (which is qualitatively defined) is to choose the "best" in terms of the whatever perspective(s) is invoked in the decision or choice problem – self, group, community, institution, or society – based on commitments to categories of personal, professional, religious, moral, emotional, institutional, economic, and aesthetic values.

1) Level 1 thresholds identify those components, attributes, or aspects that an alternative must have. When an alternative is evaluated at this level, the criterion is that it "has to have" a certain aspect. These are the most basic or primary thresholds and should be narrow in their definition. There are no trade-offs implicit in this level. Within this level, the 'have-to' attributes are hierarchically (lexicographically) ordered. It is at this level that alternatives or options available to the decision maker are reduced to admissible alternatives. Conflicts at this level are between value commitments, and may not be resolvable if different commitments are equally strong. However, a set of alternatives evaluated at this level can contain an unrestricted dominant one (Lockwood, 1996). Motivations may include, but are not limited to, morality, personal needs, societal needs, religious creeds, de facto and de jure rights, ethics, senses of community, and justice. All decision strategies concerning level 1 information must be non-compensatory in the sense that one right is not being traded off for another right, but that one right supersedes or takes precedence over the other one.

2) Level 2 thresholds identify those aspects that someone would like an alternative to have. The criterion of evaluation at this level is that the evaluator 'would like it to have' a certain aspect. For example, all else equal, someone may prefer more A to B so long as a minimum level of B is provided. Therefore, when evaluating alternatives, this person 'wants' more A, and therefore chooses the alternative that satisfies this condition within the restriction that they cannot threaten (fall-below) level 1 threshold requirements. Decisions at this level are concerned primarily with determining permissible strategies of evaluating the admissible alternatives. A set of alternatives evaluated at this level can contain a qualified dominant one (Lockwood, 1996). Thus, decision about permissible strategies will be a function of complexity, uncertainty, values, consequences or outcomes of choices, positive or negative framing of outcomes (whether they be gains or losses), and normative-affective factors. Conflicts at this level will be between different levels of values. Level 2 motivations may be personal wants, desires, expectations, values, personal goals, tradition, institutional goals, and social well-being. Decision strategies invoked concerning level 2 information can be either compensatory or non-compensatory, depending upon the factors leading to permissible decision strategies, especially complexity, and strength of an individual's values.

3) Level 3 thresholds are identified if only for logical completeness. All other attributes may be treated indifferently. By indifference I mean that these attributes are substitutable and infinitesimally tradable resulting in continuous, differentiable trade-off functions. At this level, one can maximize (optimize) an individually-defined, quantitative objective function based on the different qualities of the other attributes. But only insofar as the level 1 and level 2 thresholds have been satisfied. Level 3 thresholds are tautologically defined by the objective function of the problem, i.e., (constrained) maximal or optimal solutions are acceptable, all else are unacceptable. The restriction to maximizing (optimizing) level 3 thresholds is that choices cannot threaten level 1 or level 2 thresholds. There will be no real conflicts at this level. Decisions at this level will be undertaken only if there is a tie between two or more alternatives based on level 1 and level 2 decisions, i.e., there are no conflicts, just indifference between the surviving alternatives. Choices at this level convey no information concerning an individual's value commitments, values and preferences, since

he/she is indifferent between the outcomes, but must choose one. Alternatives evaluated at this level may contain weakly comparable and commensurable ones.

Non-compensatory or sequential processing decision strategies directly incorporate thresholds in the decision process. The strength of one's value commitments, the rank of these commitments in a hierarchy, and the unwillingness to trade between value commitments are all factors that can lead to the use of non-compensatory strategies to resolve conflicts in values. Therefore, the concept of thresholds, whether subjective, objective, or normative, play a central role in people expressing their values. The exact role of thresholds in decision making, what these thresholds are, and for what kinds of issues thresholds are most important in expressing values or preferences, are all empirical questions that need to be investigated.

For example, a well-known problem in economic environmental valuation is the embedding effect. If the resource levels used in the problem statement of a questionnaire survey are all above, below, or within a perceived threshold, it is expected that the stated value of the resource would be invariant or insensitive to the different levels of the resource due to indifference for the biologically relevant levels. If the stated resource levels cross a perceived critical threshold resulting in a structural change in a respondent's value for the resource change, then it would be incorrect to assume a continuous or marginal change in value over incremental changes between the two stated resource levels, i.e., the good is lumpy and the change is perceived to be non-marginal.

Also, for policy purposes, when the object of valuation studies trigger normative-affective factors that are significant to level 1 threshold effects for a substantial potion of the survey sample, then it should be less acceptable to treat these individuals as 'outliers' or 'nonrespondents'. In this case, important value information for the policy-affected population would be deliberately ignored. It is questionable whether 'good' policy can be developed from inadequate or mis-information.

IMPLICATIONS FOR VALUATION OF ENVIRONMENTAL MANAGEMENT AND POLICY

So what does all this mean for the valuation of environmental management and policy issues? If nature provides a necessary environment for human survival, then decisions about the natural environment may invoke level 1 factors as previously identified. In addition, the different concepts of rationality make most all value expressions permissible. The construction of preferences makes divergent expressions of values and preferences contextual and relevant. The various decision strategies permit variety in the manner with which different people or even the same people in different problem contexts deal with conflicts in values. And the notion of thresholds allows for non-marginal changes of value for a marginal change in resource levels. Furthermore, people may not only be unfamiliar with 'pricing' public goods, but may also reject the notion of 'pricing' public goods; public goods are issues for the citizen to deliberate, not the consumer. Along with 'pricing' public goods come all the assumptions concerning value as willingness to pay and the inequity this implies – people with lower ability to pay cannot make the necessary financial sacrifices to express their real value for the good leading to the conclusion

that the good is just not that important to them. However, on a broader level, if environmental values are not commensurable nor compensable with money, and money is not necessary to ensure environmental protection, then willingness to pay is the wrong measure and question to be asking.

The goal of much environmental valuation research is the quantification of preferences. However, given that people probably construct their preferences so that research is not discovering the values that already exist, but setting the stage for preference construction, many external factors can affect preference expressions. These factors include, but are not limited to, order effects, framing effects, compatibility effects, prominence effects, subjectiveness of probabilities, the range and mixture of the items being evaluated, the method of elicitation, the response mode, the amount and nature of the information provided, the complexity of the problem presented, and other contextual factors in the problem setting itself, or in what people bring with them. For further discussions on external factors see Gregory et al. (1993), Mitchell and Carson (1989), and Payne et al. (1992).

While many external factors may be 'corrected' through proper survey construction, it is cautioned against assuming these 'corrections' are effective, especially when hypothetical questions elicit hypothetical answers. Hypothetically speaking, people can respond within the confines of a question *as if* they made choices in the manner assumed by the researchers, e.g., as instrumentally rational individuals substituting money for environmental goods in contingent valuation surveys. However, as Levi (1986) argues, a choice is not a choice until it is implemented or acted upon. Implementation is a necessary condition of choosing in that it is the moment at which other admissible options or alternatives are no longer available for consideration. In hypothetical settings, a decision maker can 'conclude' an intended action or intended 'choice' without eliminating other alternatives available. Thus, in survey research using hypothetical questions, an individual may provide an answer which could be significantly different than how they would choose in actual situations. In real choice situations, decisions are only evident under conditions of conflict and are quite often qualitative in nature. The desire for quantitative measures and analysis of values leads to unrealistic and untenable assumptions for decision making models in light of observable behavior.

Other factors that are internal to the decision maker that affect value expressions include whether judgments or choices are being made, the incommensurability or non-reducibility of values (value pluralism), an inability or unwillingness to trade (whether lexicographic preferences due to ethical views or effects of perceived thresholds), the lack of monetary representations of environmental goods, multiple modes of concern resulting from value commitments (personal, professional, economic, institutional, communal, religious), conflicting values, and normative-affective factors. For example, if people hold two irreducible sources of utility – pleasure and morality – empirical evidence suggests that "objects subject to moral commitments and those that are sources of pleasure cannot be 'exchanged' in the same way that various objects of consumption can be traded among one another, and that such exchanges, to the extent that they do occur, are poorly conceptualized by market models" (Etzioni, 1988, pp. 67). Furthermore, "people [may] seek a *balance* between their moral commitments and their pleasures, rather than seeking to 'maximize' either" (Etzioni, 1988, pp. 67). In other words, if environmental issues

involve or are dominated by normative-affective, emotive, moral, and other value commitment factors than personal, self-seeking factors, then the market models do not apply.

In dealing with the external factors that affect people's expression of preferences, Gregory, Lichtenstein, and Slovic (1993) present five criteria they believe would improve the valuation of environmental management and policy issues, especially for economic research using hypothetical problem constructions. Their main criticism of current contingent valuation research is that holistic treatments of multi-dimensional problems impose unrealistic cognitive demands on respondents, and do not control for many of the factors that can affect preference expressions. Their five criteria include (1) accommodating multi-dimensionality of value, (2) minimizing response refusals, (3) excluding irrelevancies, (4) separating facts from values, and (5) asking the right question. The authors suggest that one way all five criteria can be addressed for environmental valuation issues is through the use of multi-attribute utility theory as developed in Keeney and Raiffa (1993). While this may improve on contemporary valuation research, it still rests on an instrumental rationality premise. The method proposed does not account for the incommensurability of values that may result from specific views people have for the resource including religious, ethical, political, or social value perspectives, as non-tradable and non-comparable value commitments. Decisions, or choices, are complex, multi-staged, multi-level events. Any model of individual decision making must take into account this complexity, which it is argued here is not reducible to a single, commensurable measurement, and hence a single over-arching utility function concept.

Therefore, not only must environmental valuation research address the external factors that can affect value expressions – such as what question is asked, how it is asked, what kind and amount of information is to be provided – but also must be open to the possibility that at least one person's values will not be elicitable, measurable, or expressible within the context or terms of the problem scenario. In such cases, finding out why people responded in the manner they did (including nonresponse to the survey or item nonresponse to parts of the survey) may be as informative as their responses. To me the biggest problem facing environmental valuation research in general, and economic environmental valuation research in particular, is the acceptance of a partially relevant paradigm that defines whose responses are valid (rational) and whose are not (irrational). Attempting to force people to respond in unfamiliar and potentially incompatible and irrelevant ways does nothing to assist decision- and policy-makers in choosing for the 'best'.

A LITANY OF RESEARCHABLE QUESTIONS
- Does the choice context affect the applicability of different decision strategies?
- Does the nature of the good make alternative behavioral models more applicable than others?
- Do people in general, or is there a group of people in particular, who use thresholds in their decision making behavior? Can these people be identified? Can these thresholds be identified? What role do these thresholds play in the decision making process?
- When is a maximization model appropriate?
- When isn't a maximization model appropriate?
- Do people tend to respond emotively toward environmental issues than other issues?
- Under what conditions are the different models applicable or appropriate?
- Under what conditions do people invoke lexicographic rules? Detect and measure?
- Under what conditions do people invoke satisficing rules? Detect and measure?
- Under what conditions is the use of thresholds applicable to decision processes? Detect and measure?
- Are trade-offs less important to decision involving environmental issues than decisions involving other social issues?
- To what extent and how do people use the information provided in a questionnaire? Would their responses differ if no information were provided, i.e., responses based on existing information, emotions, or spontaneous (instinctual-like) factors?
- Do people tend to express attitudes about social problems that are independent of the information provided, whereas they tend to respond more cognitively (rationally) for personal and/or private goods?

A LITANY OF PROPOSITIONS (for developing hypotheses and designing experiments)

- Complex problems invoke the use of simplifying rules.
- Unfamiliar problems invoke the use of simplifying rules.
- Simply-stated (vague) problems of an issue will result in different solutions than complexly-stated (detailed) problems of the same issue.
- Citizen preferences result in different solutions than consumer preferences (or the mode from which one makes choices, e.g., in fire issues, owner vs. concerned citizen vs. insurance- or tax-payer; in roads issues, personal access vs. public access vs. environmental values).
- Conflicting objectives or values result in the use of simplifying rules.
- Respondents who invoke weak satisficing will select the first acceptable alternative in a closed-question (Krosnick et al., 1996) (response order effects).
- Respondents who invoke weak satisficing will acquiesce, or agree with assertions made in survey items without regard to content (Krosnick et al., 1996).
- Respondents who invoke strong satisficing will select a status quo alternative if offered (Krosnick et al., 1996).
- Respondents who invoke strong satisficing will select a 'no opinion' option when offered (Krosnick et al., 1996).
- People with lower cognitive (information processing) abilities will use simplifying rules more frequently.

- People with higher cognitive abilities will use more and/or require more information in order to make a decision.
- Too much information will cause low cognitive ability people to use simplifying rules or strong satisficing.
- Too little information will cause high cognitive ability people to refuse to choose.
- People make choices based on fulfilling a hierarchy of motivations.
- Controversial issues are resolved through a lexicographic ordering.
- Problems with broad scopes cross critical thresholds, and result in sequential assessments.
- Problems that identify multi-attributes result in people using sequential decision models.
- Problems that threaten lower level needs invoke lexicographies.
- Options presented individually vs. collectively vs. in subsets vs. in binary pairs will result in different rank orderings of the options by invoking different decision rules to deal with the varying degrees of complexity (or limited scope or limited information).
- Photographic representations of options will result in a ranking of options based on scenic quality (visual cues will dominate decisions or choices).
- Option differences that are small in scope (probably do not threaten a threshold) do not invoke lexicographic rules.
- Choices between multi-attribute options will result in people sequentially eliminating options by aspects (using a subset of the information provided for making a choice).
- Under 'strong' satisficing, informational cues in surveys will affect (anchor) a respondent's answer.
- People who satisfice will select the first acceptable option when options are offered sequentially.
- People who choose an option based on a lexicon will select (or eliminate) options in a manner consistent with their ranking of aspects or attributes.
- Respondents know what their threshold is for a given problem, but that the expression of these thresholds are dependent on the context of the question.
- Thresholds are the minimum levels of attributes measured between acceptable and unacceptable options, and that these thresholds are hierarchically (lexicographically) ordered based on relevant attributes.
- Personal preference (consumer) thresholds (and rankings) are different from social preference (citizen) thresholds (and rankings).
- People with lexicographic rules have dominant solutions that are not statistically identifiable.
- People with lexicographic rules have a priori dominant solutions.
- Environmental issues invoke emotive-based responses or are more sensitive to emotively-charged information than other social issues.
- People's responses are not strongly dependent on the information provided in a questionnaire.
- People respond non-cognitively to issues involving environmental goods the majority of the time.
- People's responses to environmental issues are more dependent on attitudes and feelings they bring with them, and are mostly independent of the information provided in the questionnaire.

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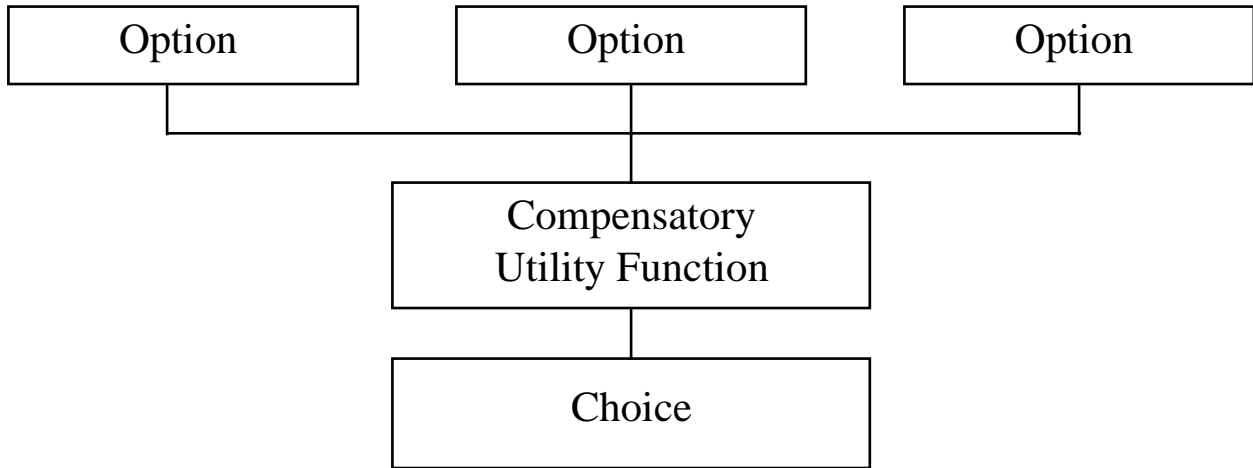
ACKNOWLEDGEMENTS

Figure 1. A simple compensatory model. All options are compared, simultaneously by their attributes, the one being selected that maximizes a utility function. All aspects are comparable and compensable. The intermediate step can be any of the identified compensatory strategies.

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┌─────────────┐      ┌─────────────┐      ┌─────────────┐
│   Option    │      │   Option    │      │   Option    │
└──────┬──────┘      └──────┬──────┘      └──────┬──────┘
       └─────────────────┬──┴─────────────────────┘
                         │
                ┌────────┴────────┐
                │  Compensatory   │
                │ Utility Function│
                └────────┬────────┘
                         │
                ┌────────┴────────┐
                │    Threshold    │
                │(Objective or goal)│
                └────────┬────────┘
                         │
                ┌────────┴────────┐
                │     Choice      │
                └─────────────────┘
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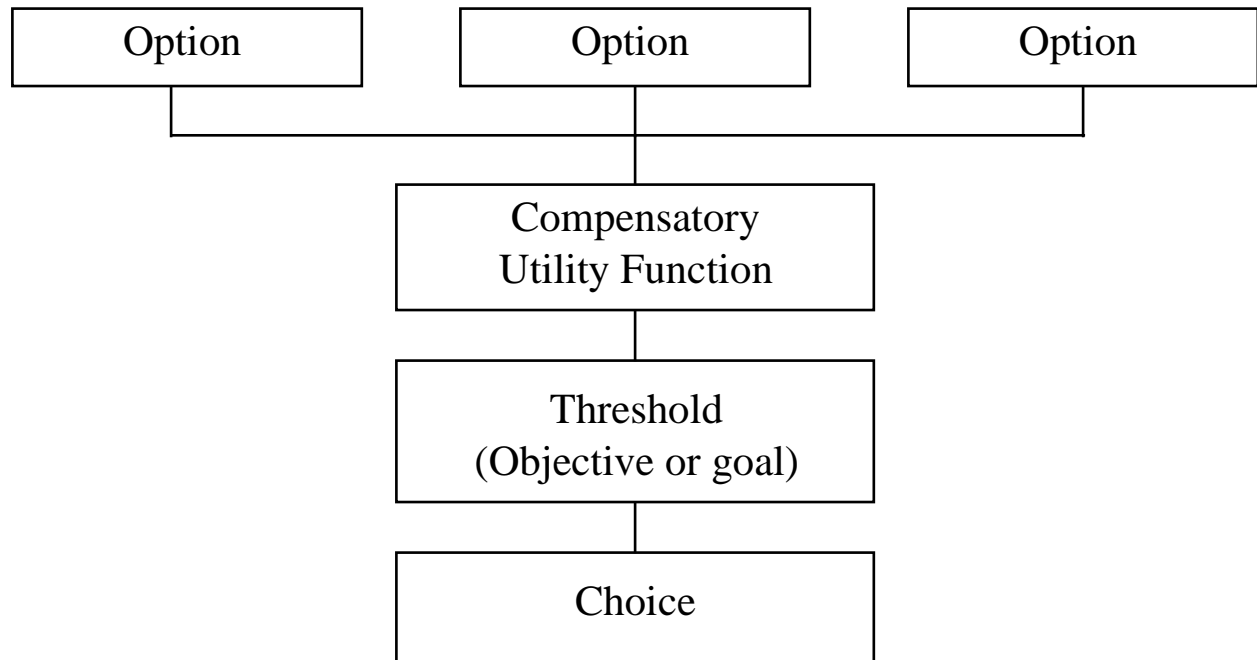
Figure 2. A weak satisficing model. All options are simultaneously compared based on a compensable utility function, however, the selection of the preferred option is the one that satisfies a pre-determined threshold (goal or objective). The option that is chosen provides the greatest level of 'goods-satisfaction'; not necessarily a maximal solution.
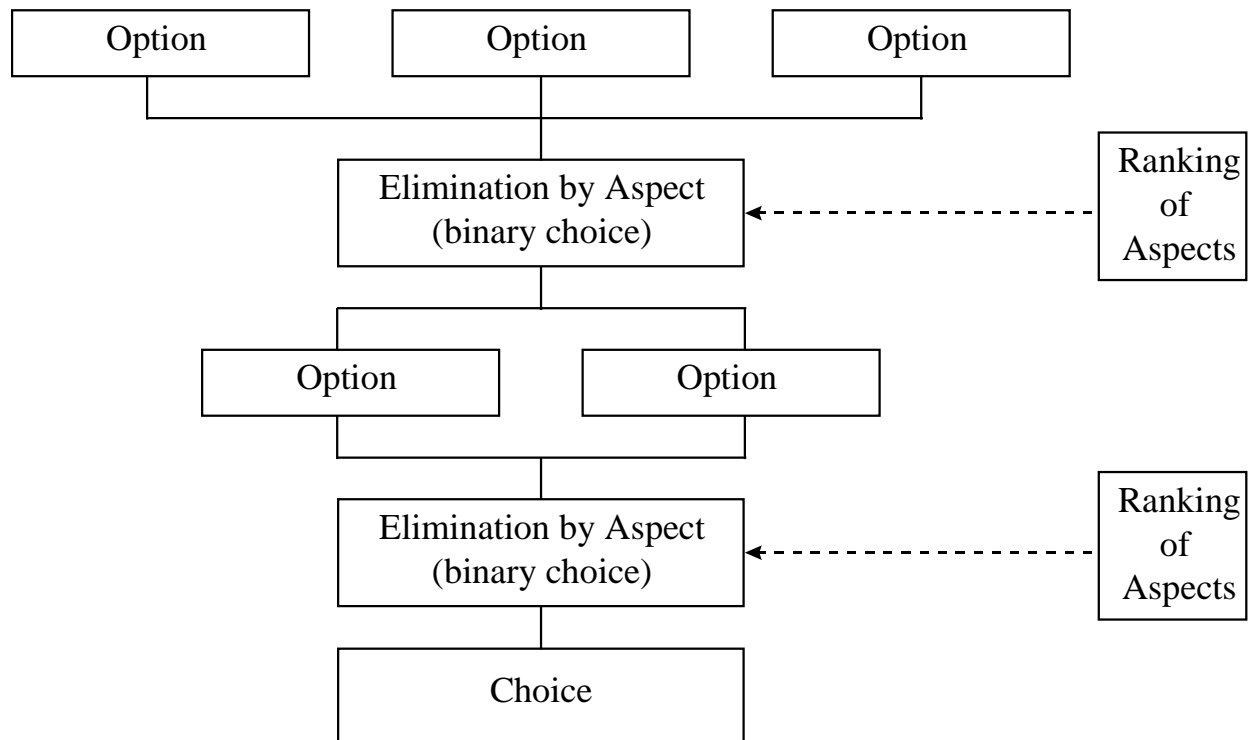
Figure 3. An elimination-by-aspects model. Each option is evaluated based on a series of aspects. Options are eliminated that do not meet, contain, or exceed the aspect or level of an attribute. Each choice is sequentially a binary choice until only one option remains. The sequence of the aspects for evaluating each option can change based on context; they are probabilistic.

Lexicographic rules are fixed orderings of the importance of aspects and do not change according to context.
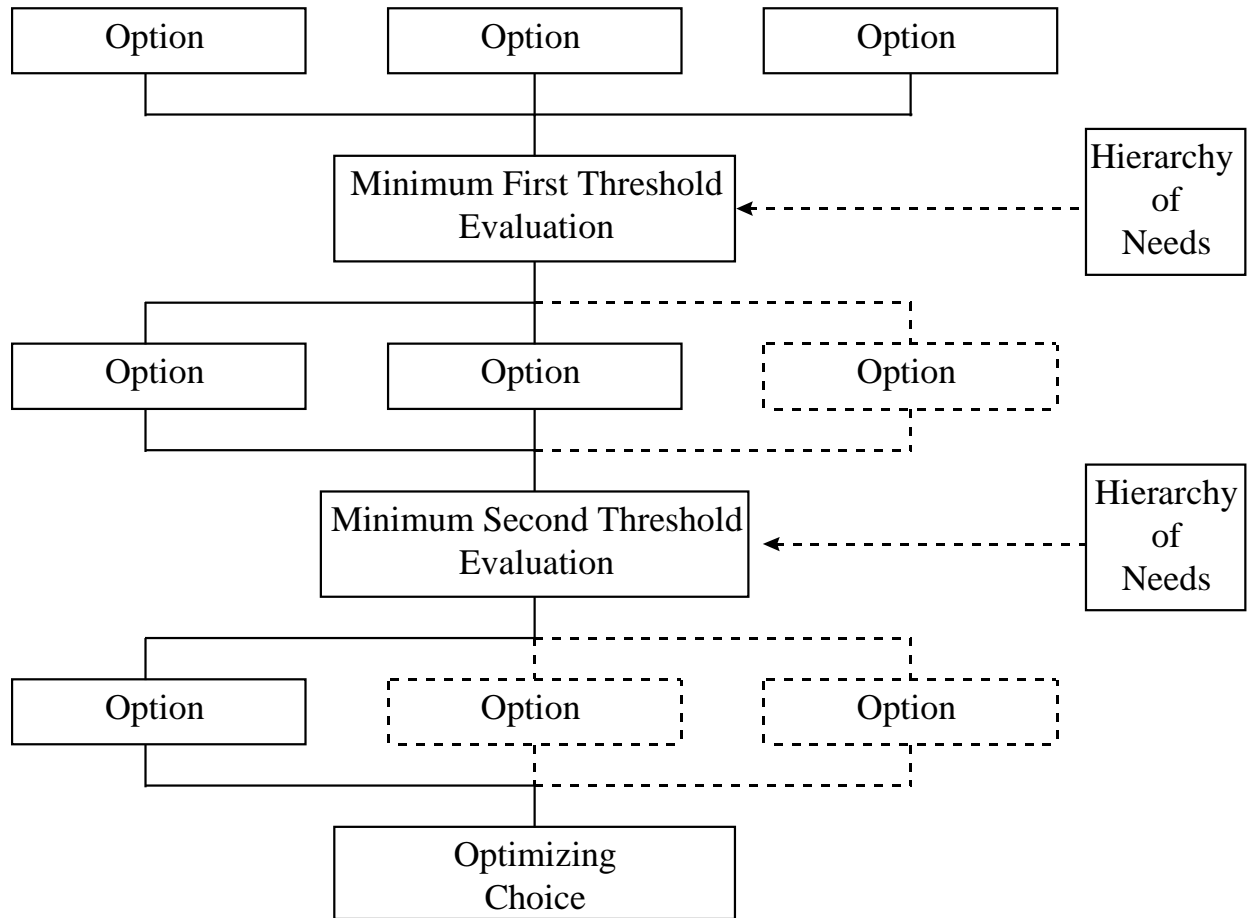
Figure 4. Maslovian hierarchy model of attaining minimum thresholds. All options are evaluated based on a hierarchy of needs-fulfillment. Options remain which satisfy a basic minimum level of need. Once all options are determined to fulfill the most basic need, or at least not threaten or violate the need, then the remaining options are evaluated based on the next level of need. If more than one option provides the opportunity for fulfilling all needs, some other means for adjudicating between them may be needed, otherwise the individual should be indifferent.

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┌──────────┐     ┌──────────┐     ┌──────────┐
│  Option  │     │  Option  │     │  Option  │
└────┬─────┘     └────┬─────┘     └────┬─────┘
     └───────────┬────┴────────────────┘
          ┌──────┴────────────┐
          │     Evaluation     │
          │ Threshold-criteria │
          └──────────┬─────────┘
     ┌───────────────┼──────────────────┐
┌────┴─────┐     ┌───┴──────┐     ┌─────┴────┐
│  Option  │     ┆  Option  ┆     │  Option  │
└────┬─────┘     └──────────┘     └─────┬────┘
     └───────────────┬─────────────────┘
          ┌──────────┴─────────┐
          │   Compensatory     │
          │  Utility Function  │
          └──────────┬─────────┘
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          │      Choice        │
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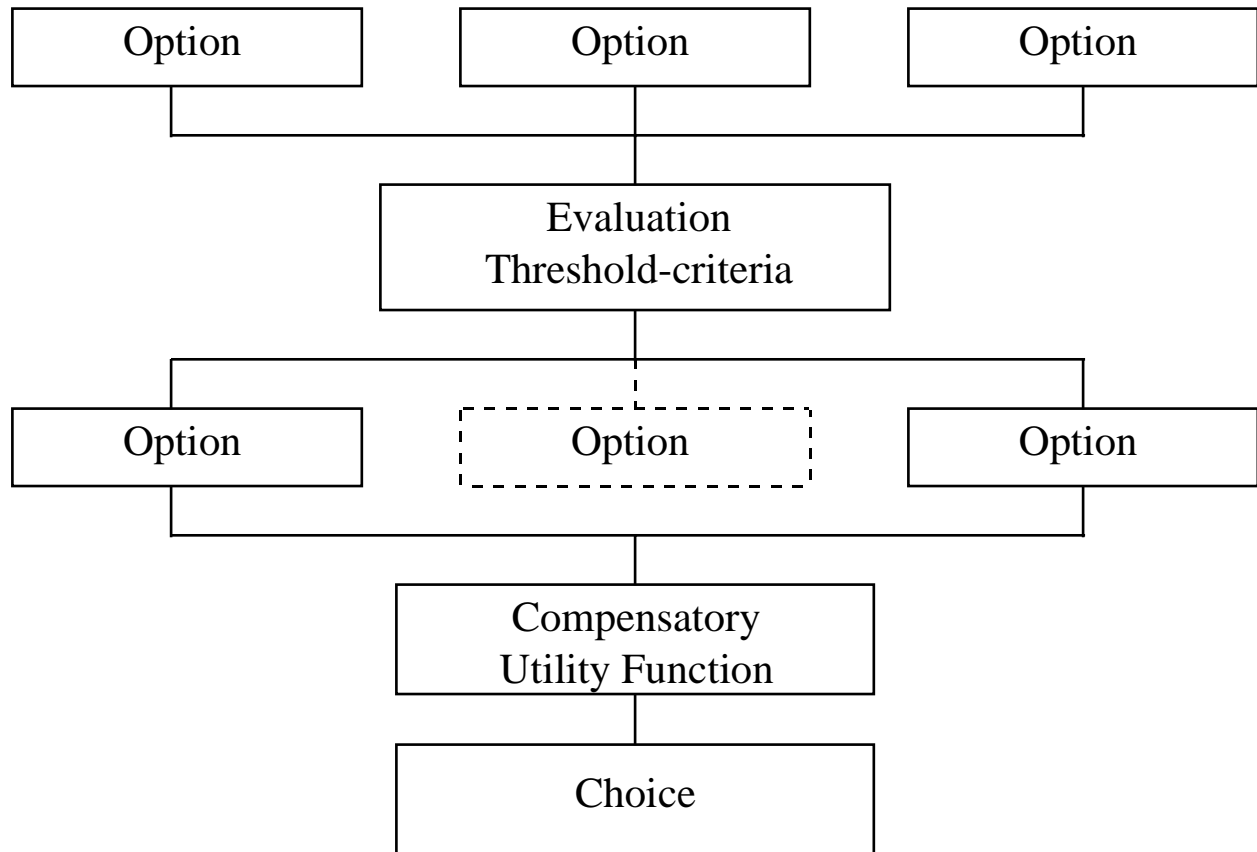
Figure 5. A hybrid model. Combinations of the different elements of each of the previous models are possible. In the above case, the options are first evaluated based on some criterion using non-compensatory strategies. This narrows the individual's choice set to only those options that survived the initial cut or are admissible. At this point, a compensatory strategy may be used to decide on a 'best' option.

OPTION 1
(V3, W1, X4, Y1, Z5)

OPTION 2
(V, X, Y, Z)

OPTION 3
(V, W, X2, Y, Z)

OPTION 4
(V2, W1, X4, Y3, Z1)

OPTION 5
(W, X, Y, Z)

LEVEL 1 THRESHOLD
STEP 1
RULE: MUST HAVE V

OPTION 1   OPTION 2   OPTION 3   OPTION 4

LEVEL 1 DECISIONS

LEVEL 1 THRESHOLD
STEP 2
RULE: MUST HAVE W

OPTION 1   OPTION 3   OPTION 4

LEVEL 2 THRESHOLD
STEP 1
RULE: WANT X>=X3

OPTION 1   OPTION 4

LEVEL 2 DECISIONS

LEVEL 2 THRESHOLD
STEP 2
RULE: WANT Y>=Y4

OPTION 1   OPTION 4

COMPENSATORY UTILITY FUNCTION
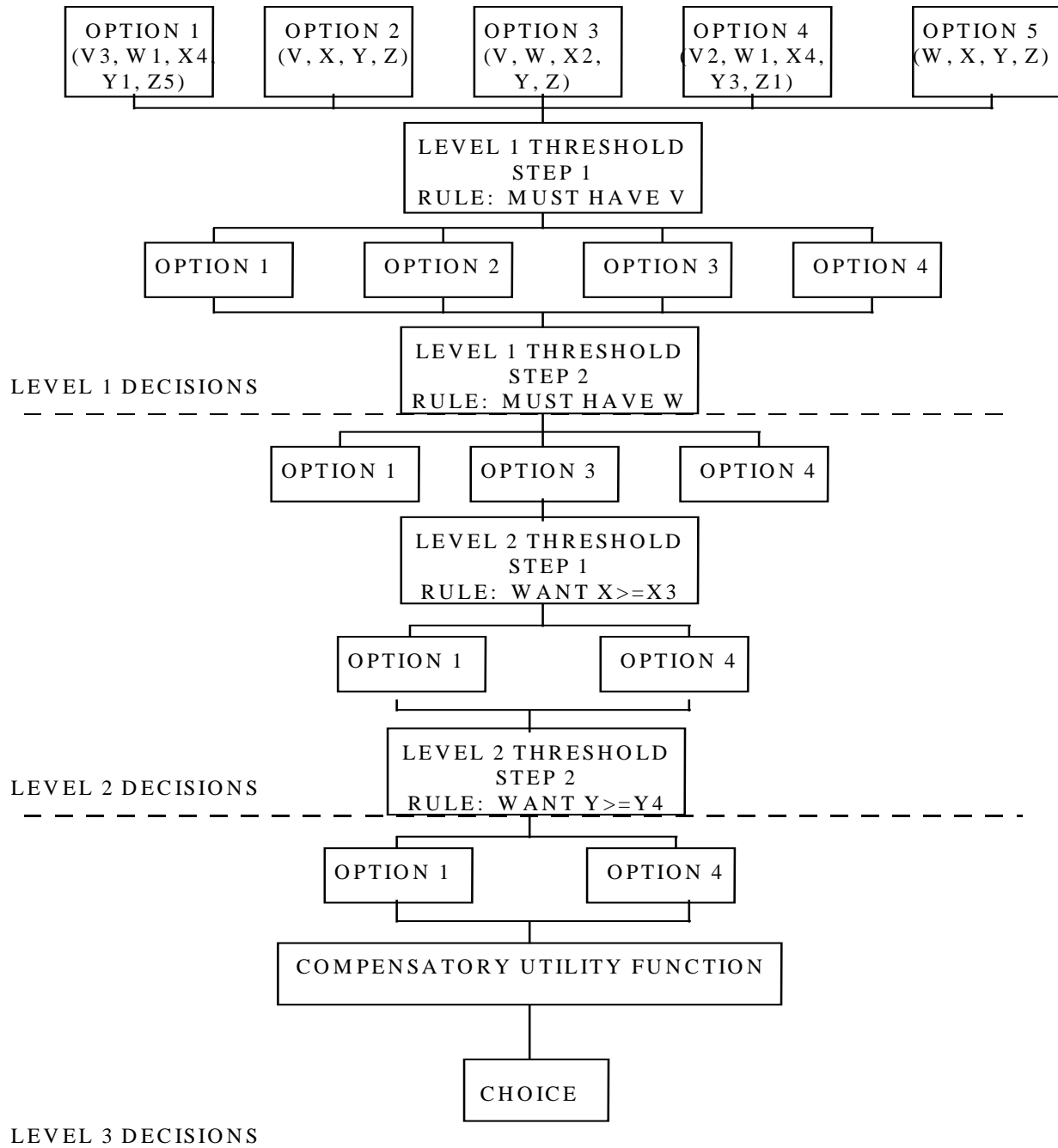
CHOICE

LEVEL 3 DECISIONS

Figure 6. A three-level threshold model. Discussion next page.

Dicussion: Figure 6.

Description: The choice set contains five options. Each option has five attributes. Each attribute can have one of five values, with 1<2<3<4<5.

Threshold level 1 contains the 'have-to's', level 2 contains the 'want-to's', and level 3 are the 'indifferent to's'.

Threshold level 1, step 1 states that each option 'must have' V present. This is a narrowly defined threshold. OPTION 5 has no V, therefore it is eliminated from the choice set. The problem now consists of 4 options with 5 attributes each. V will not be considered again unless it enters another rule later in the sequential or simultaneous processes.

Threshold level 1, step 2 states that each option 'must have' W present. This rule is lexicographically after the step 1 rule. OPTION 2 has no W and is therefore eliminated from the choice set. The problem is now down to 3 options with 5 attributes each. W will not be considered again unless it enters a later rule.

Threshold level 2, step 1 states that we 'would like' each option to have at least X_3 amount or quality of X. OPTION 3 only has X_2 level of X and can be eliminated from the choice set. We are now down to 2 options with 5 attributes each.

Threshold level 2, step 2 states that we 'would like' each option to have at least Y_4 level of Y. None of the remaining options have $Y > Y_3$. Therefore, both options remain in the choice set.

Threshold level 3 has a defined compensatory trade-off function that compares the attributes of the options with other issues the individual may have (budget constraint, effort, perceived probabilities) and maximizes (optimizes) utility based on the reduced choice set between OPTION 1 and OPTION 4. For example, a choice function can be defined that includes the relevant features of the decision process: C=f(V,W,X,Y,Z | V>0 and W>0).

It is important to note that the ordering of the rules, the pathway chosen for selecting an option, and how one treats thresholds defined under level 2, can greatly affect the final solution (choice) to the problem.

Option 1
(Good 1)
(Public values)

Superior

Strictly
superior

Inferior

I

Superior

Strictly
inferior

Threshold
(indifference
curve)

Inferior

Narrow Threshold

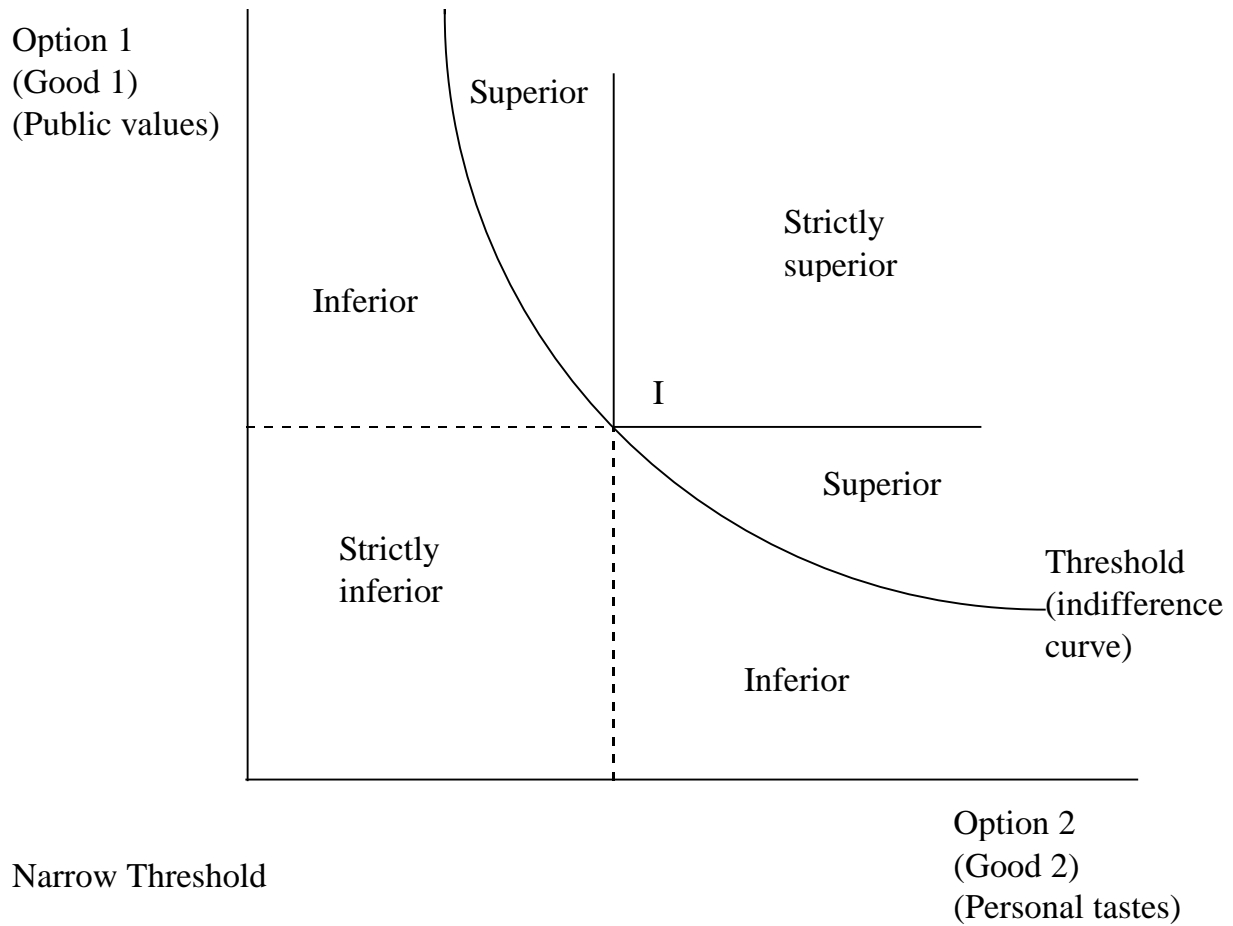Option 2
(Good 2)
(Personal tastes)

Figure 7. Narrow threshold. All points to the right of the curve are superior, all points to the left of the curve are inferior.

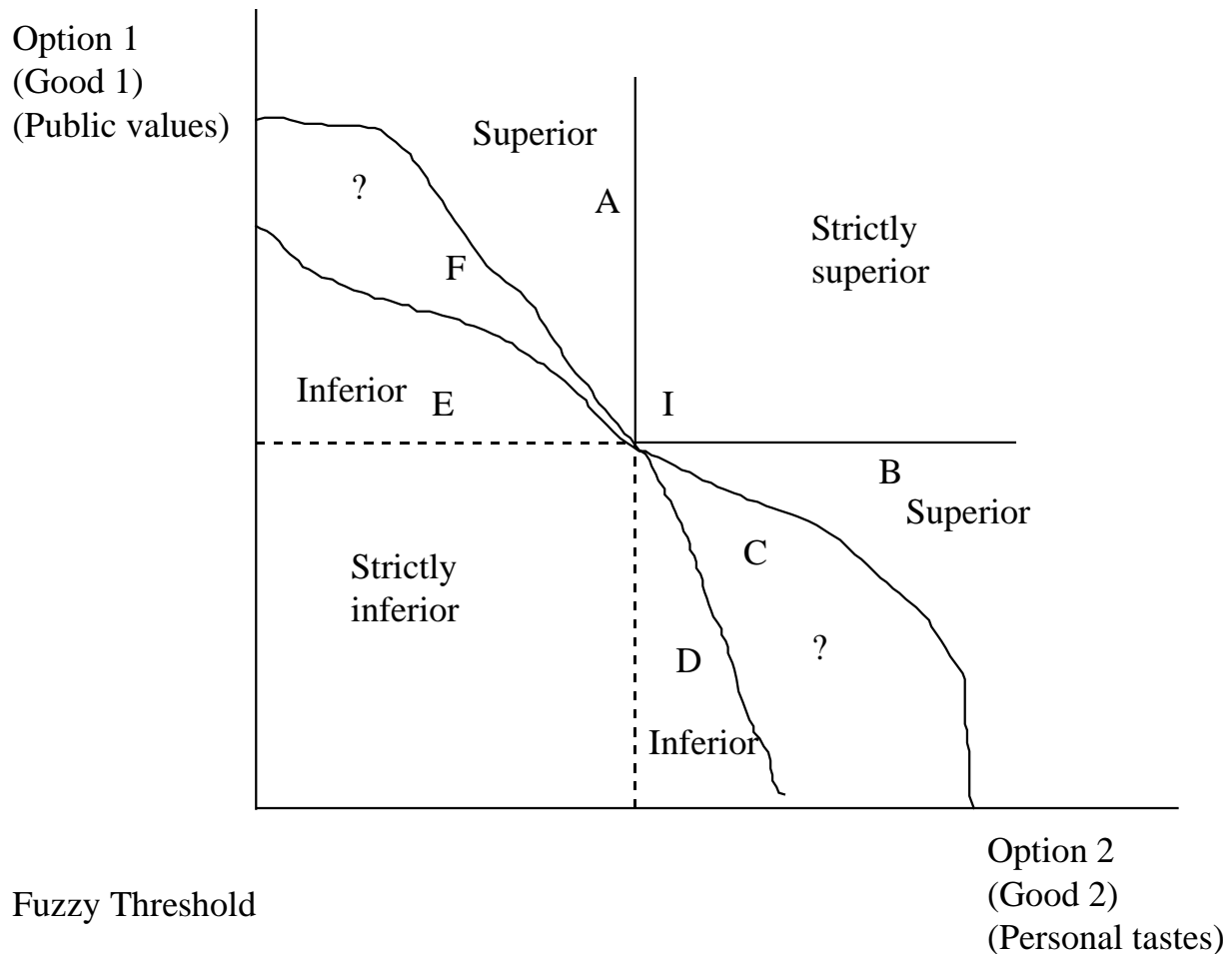Figure 8. Fuzzy thresholds. All points between the non-parallel lines are contained within the bounds of the threshold. This is an area of values conflict or ambivalence, where choices are difficult and trade-offs ambiguous. Simplifying rules such as satisficing, rules of thumb, or lexicographic rules, are enlisted in order to adjudicate conflicts. (Opaluch and Segerson, 1989)

An individual's initial endowment is at point I. All points to the northeast are strictly superior – there is an increase in both goods. All points to the southwest of I are strictly inferior – there is a decrease in both goods. Point B may be superior because a large gain in good 2 is obtained for a small loss in good 1. Point C is in the area of ambiguity. Point D may be inferior because relatively little of good 1 is obtained for a large decrease in good 2. Point E may be inferior because a small gain in good 2 is obtained for a relatively large decrease in good 1. Point F is in the area of ambiguity.

However, all of these comparisons assume some sort of trade-off. In certain cases, if the elements being compared are between public values and personal tastes, and public values are lexicographically primary to personal tastes, then only those points to the northeast of I are acceptable outcomes. All other points are rejected on the basis of the first lexicographic rule. There is no ambiguity involved in these issues because the level of personal tastes is irrelevant to the decision process.
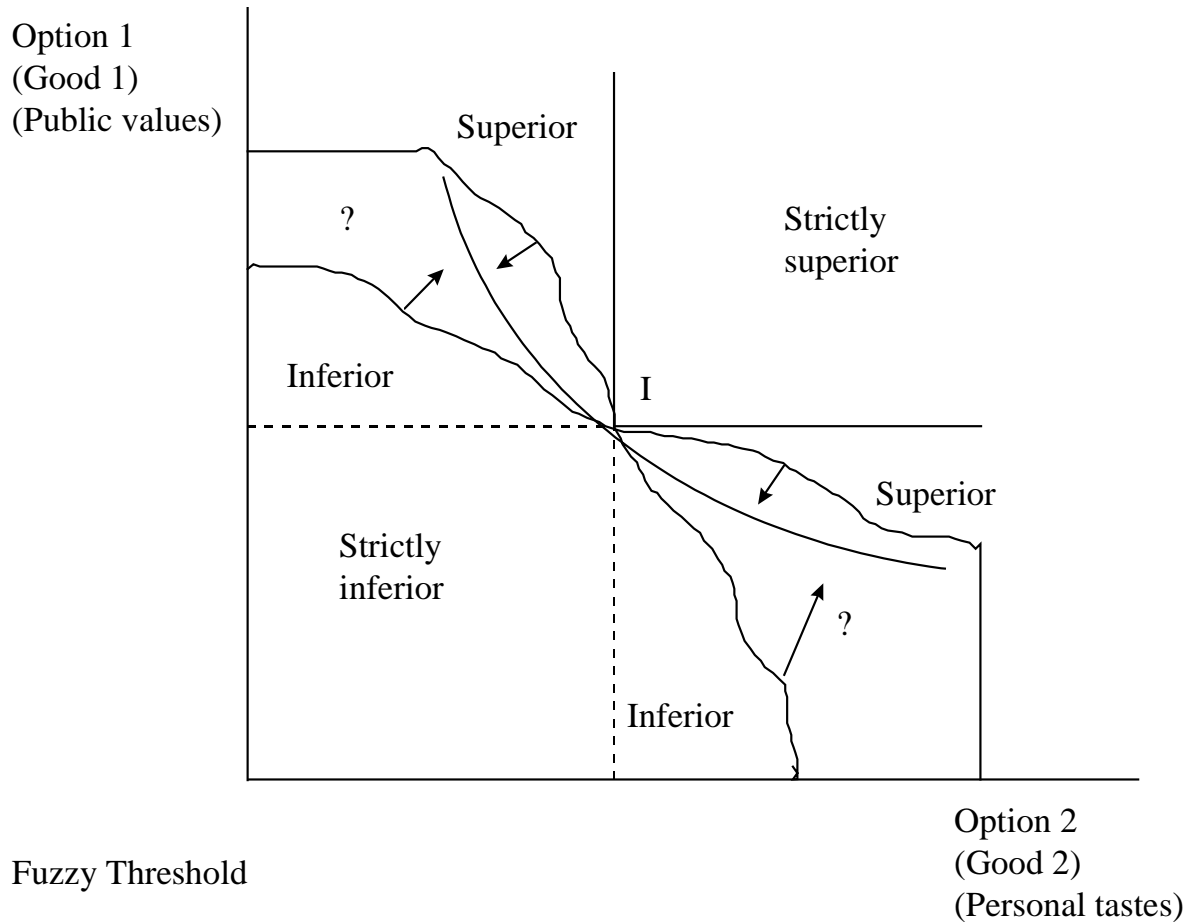
Figure 9. Fuzzy thresholds for some people, in certain contexts, or with the use of simplifying rules, may collapse to a narrow threshold. All value conflicts are resolved. (Opaluch and Segerson, 1989)

Option 1
(Good 1)
(Public values)

Superior

Strictly
superior

?

Inferior

I

Superior

Strictly
inferior

?

Inferior

Option 2
(Good 2)
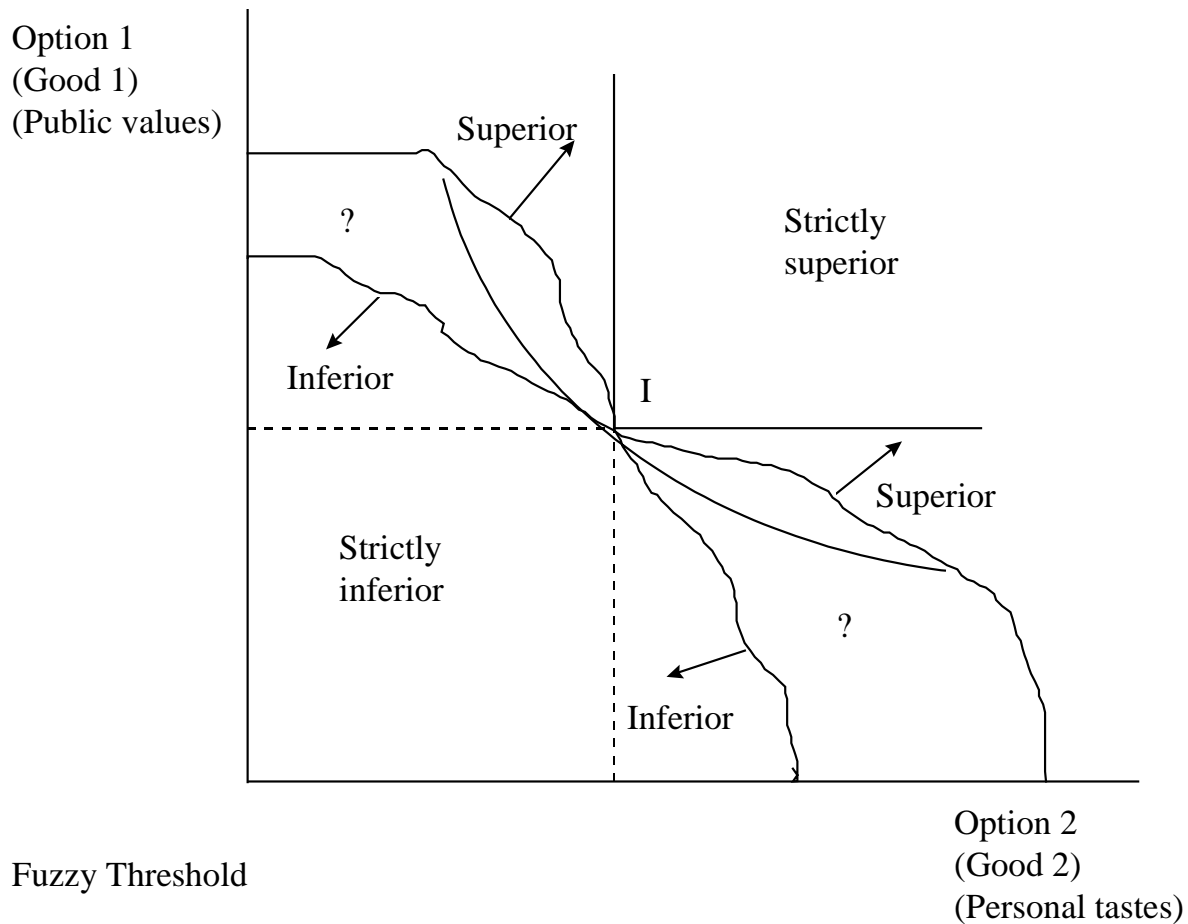(Personal tastes)

Fuzzy Threshold

Figure 10. Fuzzy thresholds, for some people, within certain contexts, may expand to include the entire area of ambiguity or ambivalence. For these people, some decision simplifying rule is the only way to make a choice. For these people, the only clearly drawn lines are between strictly superior and strictly inferior solutions. (Opaluch and Segerson, 1989)