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DISTRIBUTIVE JUSTICE IN RESOURCE-ALLOCATION

A Thesis

Presented to

The Faculty Department of Psychology

The College of William and Mary in Virginia

In Partial Fulfillment

Of the Requirements for the Degree of

Master of Arts

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by

Antoinette T. Marty

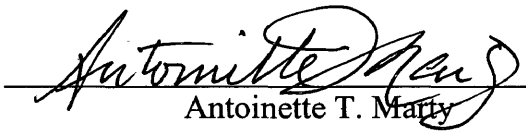
2002

APPROVAL SHEET

This thesis is submitted in partial fulfillment of

The requirements for the degree of

Master of Arts



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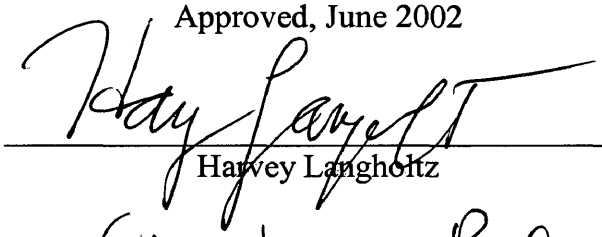

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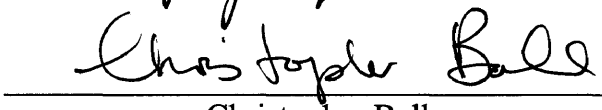

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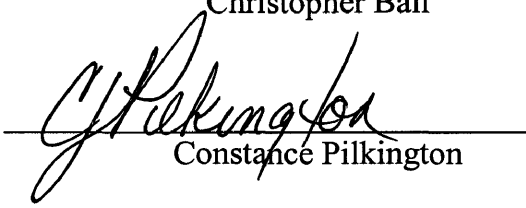

Constance Pilkington

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ABSTRACT

Various resource-allocation schemes that have been identified in the distributive justice literature were examined in peoples' resource-allocation behavior. While resource allocators must operate within the constraints of available resources, they can employ allocation schemes defined by various definitions of fairness. Individuals and 3-person groups solved a 3-dimensional resource-allocation problem, which was placed in the context of 3 different resource-allocation scenarios corresponding to the principles of distributive justice (i.e., equity, equality, and need). Individual members of a separate treatment group took on different perspectives that corresponded to 3 alternatives. Results indicated that resource allocators have a tendency to make distributive decisions based on their perceptions of fairness derived from the embedded resource-allocation context of the resource-allocation problem.

DISTRIBUTIVE JUSTICE IN RESOURCE-ALLOCATION

INTRODUCTION

Whether distributing funds among favorite charities, finding time for both work and leisure, or dividing attention among children, people allocate their resources based on what they can afford and how they are able to manage the complexity of the resource-allocation situation. Some resource-allocation decisions that pervade everyday life are made effortlessly, while consequential decisions demand thorough inspection of the problem and contextual factors. The primary yet complex challenge of resource-allocation problems is the selection among alternatives that are similarly desirable and viable. For each selection, resource allocators must carefully evaluate the alternatives to make decisions appropriate to the situation. Resource allocators must also consider inevitable resource constraints that can limit what they want to achieve. The sophistication of these tasks makes evident that the study of resource-allocation behavior is complex and difficult.

Psychological issues manifested in resource-allocation behavior have been explored when resource changes and fluctuations occur (Ball, Langholtz, Sopchak, & Auble, 1998; Langholtz, Gettys, & Foote, 1993, 1994, 1995), when individuals and groups make decisions (Gonzalez, 2001), and when social relationships are integrated into the context of the problem (Marty, 2001). Components of the problem, characteristics of the decision makers, and situational contexts are fundamental elements of resource-allocation decisions. However, in resource-allocation research, these fundamental elements have not been addressed simultaneously. While these essential

aspects compound the difficulty for isolating strategies used for problem solving or optimal decision making (Payne, Bettman, and Johnson, 1993), they are realistically manifested together in concert. A complete understanding of resource-allocation behavior might be better fostered if aspects of the problem structure, decision maker, and situation were integrated in one experiment (as it is in the real world). This thesis will present resource-allocation behavior in three major components. Part one will be a discussion of resource-allocation situations where various resource-allocation schemes derived from three distributive justice principles can be employed. Part two will be a discussion of resource allocator types and people who are affected by their decisions. Part three will be a discussion of the generalities resource-allocation behavior, previous resource-allocation literature, and a three-dimensional resource-allocation problem that was provided to participants in the present study.

Circumstances Surrounding Resource-Allocation Decisions

Decisions are governed by countless factors, some of which are completely relevant to the decision-making task and some of which are more peripheral than essential. The obvious initial step of the resource-allocation process is to evaluate the resources that are to be distributed. Encased in a set of circumstances, resource-allocation problems are generally defined in terms of resource amounts, availability, and resource constraints. Resource allocators must gather as much information about the availability of resources. How much do they have? Is there likelihood that they might lose resources over time? If they are susceptible to a loss, how much of a loss might they encounter? Is there a possibility to gain resources? While fluctuations in resources might occur, sometimes the probabilities of the changes are known and therefore can be anticipated.

Even with the knowledge of resource amounts, forewarning of fluctuations, and resource constraints, resource-allocation problems might seem daunting to assess mathematically without the help of normative techniques (i.e., Linear or Integer Programming) that will allow the resource allocator to obtain one or more optimal solutions. However, when faced with a resource-allocation decision, people do not normally have a resource-allocation handbook at hand. While optimal solutions are not readily accessible to someone naïve to normative models for solving resource-allocation problems, resource-allocation problems appear to come intuitively nonetheless. Whether budgeting money and time for food or deciding if it is "movie" or "bowling" night, tasks requiring the allocation of resources are ubiquitous and occur in familiar situations.

Contextual factors embedded in the resource-allocation experience guide allocation decisions. The resource-allocation situation might set up the problem in qualitative, rather than quantitative terms. While allocation procedures involve the computation of resources, resource-allocation behavior must be interpretable, and the situation must facilitate the explanation for distribution outcomes. These contextual factors might be peripheral to resource-allocation proper but are necessary to examine in order to secure a fuller understanding of resource-allocation behavior.

Before engaging in the resource-allocation process, resource allocators must consider all the possible ways to interpret the resource-allocation situation. Resource allocators might have to sift through superfluous information found in the context but can ask some key questions: Who is affected by the resource-allocation decision? How should resources be distributed in a fair manner? What are the consequences of a faulty decision? A whole host of situations, interpretations, and perspectives can be components

of the resource-allocation landscape, and perhaps the number of plausible settings is infinite. The resource-allocation situation is very broad to address as a general concept. There are many kinds of resource-allocation situations that are part of daily routines, many occupations, and academic study. For the purposes of this thesis, the focus will be on the examination of resource-allocation situations where the distribution of resources can potentially be made in several ways and in a fair manner.

Choosing an allocation scheme involves decision making based on the desired (and fair) distribution outcome of resources. For a resource allocator, the desired optimal solution might not be known, but he or she might have a notion about how resources can be distributed in a fair manner. Based on this judgment, the resource allocator is essentially determining what distribution outcome is "just," hence making decisions based on distributive justice.

Matters concerning distributive justice involve the provision of fair judgment. But what is fair? Because the fairness concept is subjective, distributive justice judgments might differ from one person to the next or from one situation to the next. Making a generalization that one allocation scheme is appropriate for every person and for every resource-allocation situation would be presumptuous and shortsighted. However, certain aspects of resource-allocation situations (or the information regarding these situations) might signal a resource allocator to distribute resources in a particular fashion.

Establishing fairness norms in resource-allocation situations. One of the key concerns of resource-allocation research is to determine how allocators approach a resource-allocation problem and justify distributive outcomes as fair. One of the leading theoretical frameworks for distributive justice was initiated by Deutsch (1975). His

conceptualization of distributive justice was defined as the distribution of conditions or goods that affect the well-being of a recipient (a) by the values underlying the primary rules of distribution, (b) by rules that represent the values, (c) by the implementation of rules, or (d) by the decision-making procedures. In sum, people do not always share the same values. Consequently, disparate values among providers lead to disagreement about how rules should be implemented, or even accepted at all.

Matters concerning distributive justice involve the provision of fair judgments. Fairness is an important consideration when making decisions but is also subject to interpretation of the problem (Harris & Joyce, 1980) and the social context (Leventhal, 1980). Distributive justice is involved with the perceived fairness of an allocation decision, not only by the resource provider but also by the recipient (both are actors in a resource-allocation situation that I will explain here). Resource *providers* examine the criteria of fairness before they make decisions. They have the privilege, responsibility, and authority to make resource-allocation and distribution decisions to others. Their decisions affect others, including the agency or organization they might represent and (perhaps more significantly) the resource *recipient*. It is important for the resource provider to consider fair distributions based on conditions of the resource recipients and the resource-allocation situation. Resource recipients assess the fairness according to the decision outcome.

The criteria for obtaining fairness outcomes are tangled in the distributive justice situation but represent independent perspectives of the provider and recipient. For example, a single mother must schedule her day so that she can meet the needs of her three children, ages 2, 10, and 12. Today is the 12-year-old's birthday, and he was

promised a birthday celebration this evening. Tonight, however, the 10-year-old has a piano recital. The decision to attend one event (and not the other) is a benefit that one child experiences but is a disappointment of another child. Moreover, the mother has a toddler on her hands. The scheduling complications are obvious because the consequences (i.e., discontentment, disappointment, and temper tantrums) can be detriments to decision-making if her children feel that they are recipients of an unfair decision. Therefore, decision makers such as the mother must anticipate possible reactions before dictating allocations.

When forecasting possible outcomes, resource providers predict reactions to and consequences of their decisions. Needs, wants, beliefs, and prior expectations are a few among a multitude of factors that validate fairness judgments when comparing possible outcomes (Bazerman, White and Loewenstein, 1995). Distribution outcomes are expected to favor the welfare of recipients as a whole (Deutsch, 1975); however, some research has demonstrated that outcomes actually favor a self-serving direction (Pepitone, 1971). This bias reflects interpersonal transactions that occur when making fairness judgments as well as the effect of multiple comparisons of possible decision outcomes as compared to a one-time evaluation. Bazerman et al. (1995) conducted research on potential fairness outcomes presented in isolation and outcomes presented among other possibilities. Fairness norms were justified if outcomes were presented in isolation, in that people tended to prefer interpersonal comparison of outcomes over the maximization of personal gain when judging the fairness of the situation. However, when multiple outcomes were presented together, people were less concerned with the comparative payoff and more

concerned with maximizing their own payoff (i.e., maximizing benefits and minimizing burdens).

Resource-allocation decisions may involve an exchange of benefits (e.g., rewards and gains) and burdens (e.g., costs and deprivation) within an interpersonal social sphere or exchange. Because one's benefits can be another's burdens, the resource provider must negotiate perspectives of the recipients and resolve unbalanced conditions (Ohtsubo & Kameda, 1998). The provider has control over what is deemed unbalanced or unfair; however, the needs of recipients can entreat providers to make distributive decisions in their favor (Skitka & Tetlock, 1992). Despite any persuasion involved, providers must approach the resource-allocation problem in an unbiased manner according to a moral code of conduct and in order to maintain integrity in their decisions (Lerner, 1991).

Impartial decision-making is an exercise of reaching settlements that are acceptable to the parties involved. In the interest of fair outcomes, resource providers evaluate the contributions and needs of those receiving benefits, and they assess the deservingness and inadequacies of those receiving burdens (Sondak, Neale and Pinkley, 1995). On the other end, recipients with the intention to obtain benefits must demonstrate merit, whereas other recipients that will inevitably receive burdens must assert their entitlement for fair outcomes. Distributive justice research has examined the effects of benefits and burdens in separate contexts. However, the discrete valences of these conditions do not necessitate independent research questions. In the present research, benefits and burdens can be conceptualized as tradeoffs in terms of a social exchange.

Some issues of distributive justice are concerned with one's relative standing with another person (Adams, 1965; Homans, 1961). How does the minority student feel when

he is not accepted into his top-choice school? How does the female executive feel when she does not get the job promotion? With respect to each situation, perhaps in actuality, there were candidates more suitable for the educational institution or job position; or perhaps the student and executive were victims of injustice. When comparative judgments show unbalanced conditions between two parties who are equally entitled for something (e.g., admission or promotion), the perception of injustice can be a source of conflict (Deutsch, 2000). Moreover, the recipient's feeling of injustice might bring about consequences that the decision maker must face. Injustice can result in temporary disappointment of an individual, or it can incite anger, or even bring about a lawsuit. Distributive outcomes not only have a bearing on the recipient, but also on the decision maker. Thus, the resource allocator must consider his or her values of justice and fairness when making decisions.

According to Deutsch (1975), the concern for both individual well-being and societal functioning underlies the values involved in justice. These values operate in social environments that effectively promote the welfare of and cooperation among the group's members. When the groups cooperate, individual interests are met and the group achieves satisfaction with the decision among its members. This satisfaction, as expressed by the perceived fairness of the decision, indicates that justice was served (Gilliland, 1993). Therefore, individuals that compose the group must each ascribe to values set forth by the social circumstances in order to have the same sense of justice felt among all group members (Wagstaff, Huggins & Perfect, 1993).

A range of distributive justice issues has been covered in the research literature, from interactions on the interpersonal level (Wagstaff et al., 1993), in an organizational

setting (Cropanzano, 2001), and on a grand societal scale (Miller, 1999). In the pursuit of justice, people are compelled to make impartial and righteous judgments to satisfy social concerns, to maintain business relationships, and to perform duties as a respectable citizen. Although the situations are quite diverse, distributive justice concerns share a common thread, in that three chief principles are characteristically employed when making fairness judgments.

Deutsch (1975) observed three resource-allocation outcomes that have guided most distributive justice lines in research: equity, equality, and need. These principles of distributive justice are contingent upon the goals of the resource providers and recipients and serve as the basis for determining outcomes. When economic productivity is the common goal, the principle of equity is employed. Many resource-allocation situations involve the scarcity of resources, and therefore not everyone can receive resources through the available means. There is a logical tendency to allocate resources in terms of their economic functions; hence, the means that produce the highest return will be employed to effectively utilize the scarce resource.

The principle of equity extends beyond a simple distribution of resources according to their availability. Equity theories (Adams, 1966; Cohen, 1987; Walster, Berscheid & Walster, 1973) are based on the idea that fair outcomes are determined by how contribution or inputs (i.e., productivity) are deposited into the resource-allocation system. The optimal distribution of resources, therefore, is contingent upon the relative standing of resource recipients in terms of their efforts and contributions to the system (Boldero & Rosenthal, 1984; Surazska, 1986). Alternatively, fairness outcomes can be

conceptualized in terms of deservingness (Cropazano, 2001). There has been much debate over what the best formula for equity is (Walster et al., 1973).

Theories of equity are not readily applicable to all decisions involving resource-allocation productivity, however. Contributions and inputs are sometimes irrelevant to the allocation situation. In some resource-allocation situations, resource recipients are not contributors to the resource-allocation system, and therefore these resource providers have no basis to make distribution decisions. In these types of resource-allocation situations, the maximization of resources might be the goal of the resource allocator. People who work in logistics and transportation, for example, transport goods from warehouses to store locations according to scheduling and geographical conveniences. The store locations themselves do not contribute anything to this particular resource-allocation system; therefore, the input dimension of equity is not applicable to all situations involving productivity or expediency. Sometimes resources, if unclaimed or never utilized, are lost and cannot be saved for later usage. Psychologically to a resource allocator, the inability to fully utilize all resources might indicate that he or she is inefficient or misused the privilege of making distribution decisions.

Equity allocations in social systems, however, might undermine the mutual goal of relationship maintenance. Resource recipients must sometimes compete for the resources. Thus, the resource provider must provide allocation schemes that will "keep the peace" among resource recipients. When fostering positive social relationships is the main goal of the provider, resources will be allocated evenly among recipients, and the equality principle is employed (Deutsch, 1975). Equal division and distribution of resources is standard behavior when resources are shared among groups, particularly in

social dilemmas (Allison & Messick, 1990; Allison, McQueen, & Schaerfl, 1992; Samuelson & Allison, 1994).

While equal division of resources has been considered an acceptable social norm in the research literature, Samuelson and Allison (1994) suggested that this practice is a function of cognitive mechanisms of individuals and can be regarded as an equality heuristic. Equality, in comparison to other allocation schemes, seems to be the easiest and fairest way to obtain a satisfying outcome (Harris & Joyce, 1980). The convenience of equality facilitates the use of heuristics, particularly when all parties favor balanced outcomes in social decision-making or in cooperative environments (Messick, 1995). One might consider a very simple example: How might a pizza be divided among those at a four-person table? The obvious answer: cut the pizza into four slices. If the pizza were cut into six slices, two people will get one extra slice each, and this distribution would not be fair to the other two people at the table. The principle of equality is not only an easy solution, but equality can also maintain social harmony among a group of hungry pizza-lovers. On a more profound level, the principle of equality is applied in today's society when we consider issues such as civil rights and employment opportunities. While equality is employed when cultivating cooperative relations and maintaining civil relationships, considerations based on need are sometimes suitable approaches for making distribution decisions in cooperative environments.

When resource providers want to implement distribution decisions to promote personal development or personal welfare among resource recipients, the allocation of resources might operate according to the needs of its recipients (Deutsch, 1975). Most of the distributive justice literature has concentrated on equity and equality (Adams, 1965;

Leventhal, 1976). Research on the distribution norm of need has been modest since its appearance in Deutsch's (1975) literature (cf. Mannix, Neale, & Northcraft, 1995; Skitka & Tetlock, 1992). The allocation of aid (e.g., social security or healthcare) is contingent on the provider's perceived deservingness of the recipient. When resources are scarce, providers tend to use their authority to deny aid to claimants responsible for their predicament (Skitka & Tetlock, 1992). Overall, the severity of need and responsibility for poor conditions must be considered in the allocation of aid.

The principles of distributive justice (i.e., equity, equality, and need) do not always surface as distinct or separate allocation approaches; therefore the appropriate allocation procedure can be ambiguous (Deutsch, 1975; Leventhal, 1976). Often the application of these principles can contradict one another, depending on how one might view the situation (Elliott & Meeker, 1986; Harris & Joyce, 1980). Conflict can arise among groups of resource allocators if they disagree on which distribution norm should be applied (Deutsch, 2000). In contrast, a confluence might exist between two or more of the principles of distributive justice in many resource-allocation contexts, in which allocators may try to adjust their distribution scheme (Greenberg, 1983). The coexistence of goals regarding interests in economic productivity, positive social relationships, and personal welfare can, unfortunately, lead to greater difficulty in reaching decisions (Mannix et al., 1995). To employ the appropriate allocation procedure, goals must be explicit and values must be assessed to determine fair outcomes (Harris & Joyce, 1980; Slade, 1980). While the evaluation of goals and values of the situation is a crucial component to decision-making and resource-allocation, it has been a neglected aspect in the study of resource-allocation behavior.

As a basis for making distributive decisions, values are central to the evaluation of justice or injustice, because the perceived values of conditions and goods vary from person to person. Deutsch (1975) identified eleven values that underlie distributive justice, and many of these values map onto the framework of the present resource-allocation examination. These values (selected from Deutsch, 1975) are determined by treating people (a) as equals, (b) according to the requirements of the common good, (c) according to supply and demand, (d) so that they have equal opportunity to compete without external favoritism or discrimination, and (e) according to their needs. Contexts, such as economic, relationship, and personal development orientations, can provide cues for assessing values that determine allocation rules for the distribution of resources (Mannix et al., 1995).

While situational and contextual aspects in the distributive justice literature have been investigated (Mannix et al., 1995), specific aspects of the resource-allocation situation have not been an explored area in resource-allocation behavior. Resource-allocation researchers have examined differences between types of resource-allocation tasks. For example, resource-allocation behavior has been examined in technical tasks (Langholtz et al., 1993, 1994, 1995) and in commonplace tasks (Ball et al., 1998; Langholtz et al., 1997). Langholtz et al. (1997) found that there were no significant differences in performance between either types of the resource-allocation task. Differences in resource-allocation behavior, however, might be explained when various interpretations of the resource-allocation situation are presented. When distributive justice principles are adapted to the task and situation, it is expected that resource-allocation behavior will reflect various interpretations of distributive justice in the

resource-allocation situation. The implementation of the principles of distributive justice, therefore, might be a useful tool for interpreting resource-allocation behavior.

Resource-Allocation Decision Makers: The Providers

What do policy makers, finance committees, and parents have in common? They are groups of providers who establish the allocation rules for the distribution of resources. Determining which distributive justice principle to employ is difficult enough for individuals, but in groups, the task might become even more complicated if there are different ways of assessing the resource-allocation situation. Resource allocators, particularly in groups, might disagree on the importance of information provided; therefore, choosing allocation schemes can be difficult (Elliott & Meeker, 1986). In distribution decision-making, the outcomes can be attributed to the situation; however, allocation preferences and characteristics of the provider is another research question to consider.

As individuals or in groups, resource providers or resource allocators must consider whom their decisions affect. Under most circumstances, resource-allocation decisions influence the welfare of the resource recipients. Especially when conditions are legitimately grim or severe, resource providers who have the authority to make decisions are essentially responsible for the well-being of all possible recipients. Characteristics of the provider can be a predictor of how providers use their authority to determine distribution outcomes. In Skitka and Tetlock's (1992) study, for example, individual providers were characterized as either politically conservative or liberal. The politically conservative allocators withheld resources for claimants who were responsible for their

predicament, regardless of the severity of need and resource availability. Liberal allocators, on the other hand, were inclined to provide resources to all claimants.

Since distribution outcomes can be attributed to certain characteristics of the provider, distribution outcomes might also be attributed to preferences of the provider. Having a preference, or inclination to choose one option over another, may depend on a multitude of factors (Tversky, Sattath, and Slovic, 1998). The inclination toward a particular alternative influences an individual's goal development and effort to achieve goals (Jansson, 1994; Slade, 1994). When two people have differing preferences or advocate a certain set of rules, the incompatibility of goals can affect the behavior of decision makers. Particularly when providers are in groups, members might hold different assumptions and employ different criteria to evaluate the situation (Tjosvold, 1988). Preferences for making distributive rules might be in conflict and goals might have to be adjusted. On an interpersonal level, people attempt to resolve conflicting goals by modifying goals to act in a cooperative manner (Slade, 1994). However, if individual goals and group goals are compatible, the task itself will be the focus of group discussion and will be facilitated through cooperation (Thompson & Hastie, 1990).

Group resource-allocation behavior. Group processes are mutable and can be modified as the group attempts to attain group goals. Ellis & Fisher (1994) identified four elements inherent in group processes. First, the group must take action on a problem or task. Second, processes occur on a continuum and change over time. Third, the group makes advancements and progress over time. Fourth, processes lead to a goal or end result. Similarly, resource-allocation behavior can be observed in terms of these elements for group processes. Resource allocators are provided with a context in which the task is

embedded. The task involves allocation procedures that occur over the course of a fixed time period in which decisions build upon each other to reach a final solution. Resource providers evaluate the solution to determine whether the goal of obtaining an optimal solution was achieved.

It would go beyond the scope of the present study, however, to examine specific group decision-making processes (e.g., social decision schemes, etc.) involved when providers determine which distribution rule to use. Distributive justice has not been investigated in the form of resource-allocation behavior in either individuals or groups. Therefore, it would be the foremost interest to examine the general performance and behavior of the providers before examining the group processes involved. Moreover, comparisons in allocation behavior must be distinguished between individual and group resource providers before examining group processes. The focus on group resource-allocation behavior is still in its early stages. Gonzalez (2001) initiated this line of research and found that group performance was superior to individual performance. This M.A. thesis study involved a replication of an experiment by Langholtz et al. (1993) and is the only experiment conducted on the topic of group resource-allocation behavior. One of the objectives of the present study is to verify that groups perform better than individuals do when faced with a resource-allocation problem.

Individual members taking on different perspectives in groups. Researchers of distributive justice have examined the perceived fairness of outcomes from either the provider's perspective or from the recipient's perspective. The present research study differs from previous research on distributive justice in two ways. First, distributive outcomes are determined either by individual resource providers or by a group of

resource providers. When cognitive resources are pooled, group performance is better than individual performance. The expectation that group performance will be superior to individual performance is based on the results of Gonzalez (2001). Second, groups were either objective resource providers or they took on various perspectives of the recipients' conditions. Various perspective-taking might provoke disagreement or conflict that can inhibit performance in a group (Hyder et al., 2000); therefore, groups with disagreeing members are expected to demonstrate performance inferior to groups whose members share the same perspective.

Resource-Allocation Problems

Observing Resource-Allocation Behavior. People are essentially veterans to resource-allocation procedures because they make these decisions frequently; therefore, the ubiquity of such decisions may go unnoticed (Langholtz, Ball, Sopchak, and Auble, 1997). Significantly incorporated in daily routines, resource-allocation decisions are made with little hesitation, and people generally experience success with the task. Research in resource-allocation behavior has demonstrated that these tasks are intuitive, even if various approaches and strategies exist for solving resource-allocation problems (Ball, Langholtz, Sopchak, and Auble, 1998).

When confronted with resource-allocation decisions, people perform close to optimal level, as defined by the methods used to observe resource-allocation behavior. Linear Programming (LP), a normative model for determining optimal solutions, functions as an applicable method for solving resource-allocation problems and is well-established in the Operations Research literature (Dantzig, 1963). Various aspects of

resource-allocation, such as the precise combination of alternatives that maximize payoffs, can be evaluated from the LP model.

The LP model quantifies payoffs and solutions on a continuous scale. Depending on the resource-allocation task, payoffs can be represented in fractional form or in whole units. In contrast to LP solutions, Integer Programming (IP) solutions are quantified on a discrete scale. The type of scale used to obtain solutions characterizes the difference between LP and IP methods. Therefore, one distinction between LP and IP models is the number of possible solutions and optimal solutions. An infinite number of solutions and one optimal solution are possible in LP problems, whereas the number of solutions is limited and numerous optimal solutions are possible in IP problems.

The means of quantifying payoffs determine the method employed for solving resource-allocation problems. For example, the LP approach can be used to determine the maximization of family quality time because time can be measured in hours, minutes, and even seconds. In contrast, the IP approach must be used when items, such as the number of meals consumed in a week, are measured in discrete units (Ball et al., 1998; Langholtz et al., 1997). Solutions are quantified by IP methods in the present study; although most of the initial resource-allocation research has used LP methods.

Linear and Integer Programming procedures were first instituted in many business industries and sectors (e.g., Operations Research, Industrial Engineering, and Management Science). However, without familiarity or experience using LP and IP methods, the average person does not typically have training or reference materials nearby to make optimal resource-allocation decisions.

Linear and Integer Programming. Two approaches to linear and integer programming (i.e., Simplex Method and graphical solution method) can be used to solve resource-allocation problems. The Simplex Method is a mathematical algorithm in which optimal LP solutions are determined mathematically. The Graphical Solution Method can well-illustrate problems in two-dimensions and three-dimensions, in which resource-constraint lines create boundaries for the feasible regions optimal LP and IP solutions are determined. In two-dimensional resource-allocation problem, each dimension represents a decision variable on the *x*- and *y*-axis. Resource constraints are represented by lines, which determine the boundaries of the feasible region. Any point can be satisfied in this feasible region. The "most attractive corner," is a maximum point in the feasible region that can be satisfied within the resource constraints and represents the optimal solution if the goal of the resource allocator is to maximize payoff. Lapin (1981) provides a detailed tutorial for using the graphical solution method to solve resource-allocation problems, and Dantzig (1997) provides a more current LP reference tool.

Adding one more dimension to the two-dimensional resource-allocation problem enhances its complexity. Figure 1 illustrates the increased sophistication of the three-dimensional resource-allocation problem. Where there were resource-constraint lines in a two-dimensional problem, there are resource-constraint planes. Each dimension represents a decision variable on the *x*-, *y*-, or *z*-axis. Resource-allocation research has not yet extended beyond three-dimensional problems. While there are an infinite number of dimensions possible in resource-allocation problems, the Simplex Method (rather than the Graphical Solution Method) would be a more feasible to research behavior in dimensions that go beyond three.

Previous research in resource-allocation behavior. The study of resource-allocation behavior is complex because it tackles the realities of resource-allocation decisions. Especially for naïve decision makers, resource-allocation tasks appear to be hefty undertakings. While many practices and applications have benefited from the normative research literature for resource-allocation decisions in business and in engineering settings, the psychological aspects of managing mundane yet important responsibilities, such as budgeting the family income or scheduling weekly appointments, have not appeared in the resource-allocation literature until recently.

The study of resource-allocation behavior originated with Gingrich and Soli (1984), who presented participants with a realistic resource-allocation problem. They were the first to integrate the LP method into the resource-allocation-behavior framework by presenting participants with a two-dimensional, one-time resource-allocation task under certainty. The participants identified their goals about physical fitness, performed a cost-benefit analysis, and formulated their strategies to maximize goals. Given a specified amount of time and money, participants were directed to maximize payoffs (physical fitness). Participants completed the task successfully; they attained at least 90% of the optimal LP solution.

Busemeyer, Swenson, and Lazarte (1986) applied the hill-climbing method to compare performance of individuals to the optimal solution. Both methods can aptly represent resource-allocation problems, but they differ in that the maximum payoff is usually approachable from any direction in hill-climbing, while the optimal solution is always on the boundaries of the feasible region in LP. Busemeyer et al. (1986) examined participants' learning in a resource-allocation problem when objectives were not initially

specified. Overall, participants were able to achieve the maximum payoff when there was one optimum but performed sub-optimally when there were multiple optima.

From the studies conducted by Gingrich and Soli (1984) and Busemyer et al. (1986), Langholtz, Gettys, and Foote (1993, 1994, 1995) expanded the nascent research in resource-allocation behavior by investigating the anticipation of changes and fluctuations in resource availability, especially when resources are allocated over time. Langholtz et al. (1993) utilized the LP method when they examined how people revised resource-allocation strategies in reaction to situations of certainty (where resources do not fluctuate over the course during a trial), risk (where the probabilities of gains or losses are known), and uncertainty (where the probabilities of gains or losses are not known) in an environment. The task presented was a sequence of eight four-day cycles, in which Coast Guard members scheduled two helicopters that required different amounts of personnel and fuel resources to fly. The goal of task was to maximize the number of flight hours, within the limited resources of personnel and fuel available.

In general, results indicated that people are satisfactory resource allocators when faced with a two-dimensional resource-allocation problem. Participants obtained solutions that were 80-90% of the LP optimal solution. With practice in this task, many scores improved to 95% of the LP solution, even without prior experience with LP. Reaching at least 90% of the optimal LP solution after only three trials, participants performed best under certainty as compared with those who were in the risk and uncertainty conditions. Under risk, participants hovered around at least 75% of the optimal LP solution but improved performance to at least 90% of the optimal LP solution after many trials. Among all conditions, performance under uncertainty was the most

deficient. Participants in an environment of uncertainty maintained performance around 85% of the optimal LP solution across all eight trials. Overall, participants demonstrated a proficiency in resource-allocation tasks, where environments under certainty were the most conducive for success; environments under risk promoted learning; and environments under uncertainty produced unpredictable behavior.

In many resource-allocation situations, vital resources are scarce and multiple losses are possible. Resource-allocation behavior in these harsh environments was examined by Langholtz et al. (1994). Participants were presented with two sequences of eight three-day cycles in which members of the Coast Guard scheduled two patrol boats with limited personnel and fuel and were instructed to sustain enough resources in order to maintain operations until the end of the task. The goal of the task was to maximize the number of underway operating hours, given a fixed amount of personnel hours and gallons of fuel. Resource-allocation environments varied by the degree of harshness: participants in the low difficulty (LD) condition, characterized as the benign environment, were required to allocate a minimum patrol of 3.5 hours per day; participants in the middle difficulty (MD) condition were required to allocate a minimum patrol of 4.5 hours per day; and participants in the high difficulty (HD) condition, characterized as the harshest environment, were required to allocate a minimum patrol of 5.5 hours per day. The difficulty of the resource-allocation task further escalated as participants experienced either zero, one, or two 6-hour personnel losses.

Overall, participants in the task conditions (i.e., LD, MD, and HD) obtained at least 91% of the optimal LP solution. Participants obtained 89% of the optimal LP solution in the LD condition, 93% of the optimal LP solution in the MD condition, and

92% of the optimal solution in the HD condition. As minimum patrol requirements were set higher, the environment presented participants with a greater challenge to survive the task. High levels of difficulty and multiple losses throughout the task imposed the need to carefully allocate resources. As expected by more stringent task demands, LD participants completed 78% of the cycles on average, whereas the average cycles completed by the MD and HD participants were 68% and 52%, respectively.

In loss situations, resource allocators did not plan for probable losses (Langholtz et al., 1993; 1994). Rather, they completed the resource-allocation task in reaction to losses. These findings prompted further investigation into situations in which the possibility of both gains and losses can occur (Langholtz, et al., 1995). Similar to the resource-allocation task presented in Langholtz et al. (1994), the problem presented in Langholtz et al. (1995) was used to replicate previous findings about loss situations as well as generalize the failure to anticipate resource fluctuations by examining behavior in gain situations.

According to the results of the Langholtz et al. (1995) study, this generalization can be made; participants prepared for neither gains nor losses. They did not pre-position themselves to handle gain and loss situations and did not directly respond to changes or fluctuations in resources. Instead, they delayed their reaction to gains and losses until the final opportunity to allocate resources. While resource fluctuations impeded planning, participants were able to achieve 90% of the optimal LP solution in both gain and loss situations. Across trials, performance was higher in gains as compared to losses; however, this performance asymmetry was not attributed to the fundamental differences

between gains and losses. Obtained solutions indicated that participants revealed a tendency to schedule alternatives in equal proportion throughout the task.

While resource-allocation performance generally reveals the intuitive nature of resource-allocation problems, Langholtz et al. (1993) uncovered a cognitive shortcut, or *equal-scheduling tendency*, that can thwart the attainment of optimal solutions. The equal-scheduling tendency was consistently observed in subsequent resource-allocation studies (Langholtz et al., 1994 and 1995), and its robustness was tested when different structures of the resource-allocation problem were presented to participants (Langholtz et al., 1997).

Resource-allocation problems can be structured in various forms, depending on a multitude of factors. In particular, the number of possible alternatives and the optimal proportion of resources to be allocated are relevant features of resource-allocation problems that can be used to classify problem structures. Langholtz et al. (1997) incorporated both dimensionality and problem configurations to examine resource-allocation behavior. A commonplace resource-allocation problem modeled with Integer Programming was presented to college students who were instructed to maximize the number of meals on a fixed budget over a seven-day period. Participants received an IP problem illustrated in either two or three dimensions, where two or three alternatives were possible. Participants given a two-dimensional problem received one of three problem configurations: symmetrical, where each alternative needed to be scheduled equally to research the optimal solution; skewed, where alternatives needed to be scheduled in a two-thirds ratio; and all-or-nothing, where to reach the optimal solution

only one alternative needed to be scheduled and the other alternative needed to be ignored.

Solutions of at least 80-90% of the optimal IP solution were obtained, and performance of individuals who received a two-dimensional problem was similar to the performance of individuals who received a three-dimensional problem. Also consistent among the task conditions was the tendency of participants to schedule alternatives equally, despite the different problem structures or configurations presented. These results confirmed the existence and robustness of the equal-scheduling tendency. When events or alternatives are distributed over a time series, resource allocators are not cognizant of unique problem structures and maintain a propensity to arrange alternatives in an equal distribution (Langholtz et al. 1997).

Subjective Values Might Influence Behavior. Two decision-making themes have dominated most of resource-allocation research. First, when resources are scarce, proper decision-making must be maintained when undertaking resource-allocation tasks to avoid waste or squandering behavior. Second, when resource availability is unpredictable, the same scrutiny of the resource-allocation problem must be maintained. These themes only take into consideration various properties of resources. When resource-allocation tasks are complex, resource allocators must tackle not only the resource-allocation problem, but they also must absorb information from the scenario that is pertinent to the task. While real-world scenarios can furnish a sensible context about the resource-allocation situation, this contextual information is purely supplemental to the mathematical details and is not necessarily required for determining the optimal LP or IP solution.

Information that is solely pertinent to resource-allocation tasks includes the types of resources, the amount of resources available, the costs of each alternative, and goals of the task. Without these problem features, resource allocators cannot reach their objective to maximize (or minimize, depending on the problem type) payoffs and resources. Specifically under the IP framework, resource-allocation task objectives are represented by the Objective Function (see Figure 2, Panel A). The Objective Function, expressed in equation form, operates as a resource-allocation guide for communicating task goals (i.e., maximize the number of projects that can be implemented in one year). Given the Objective Function or task goals, resource allocators should behave independently of any information tangential to the problem itself.

However, resource-allocation problems do not occur in a vacuum. Contexts in which resource-allocation decisions occur must be included with the presentation of the problem. Peripheral information incorporates attributes and utility of the alternatives, characteristics of the decision maker, and general aspects of the situation. Background knowledge about the task environment presents the resource allocator with a realistic, germane context for the problem. Therefore, contexts in which resource-allocation events occur are integrally connected to task performance and are therefore necessary for studying and understanding behavior.

Just as the Objective Function serves as a guide to resource-allocation problems, the Subjective Function can serve as a guide to manage in the resource-allocation situation. One way to assess the resource-allocation situation is to consider the "subjective" values assigned to each alternative or to the resources that will be spent. Consider a person (a culinary student) who enjoys cooking and is willing to spend as

much time and money it takes to prepare a gourmet meal; home-cooked meals are preferred to meals at a restaurant. Consider another person who is constantly on-the-go; time for this person might be a more valuable asset than money. Preferences for one alternative versus another or valuing some resources more than others can affect how resource-allocation decisions are made (refer to Panels B, C, and D in Figure 2). When choosing the preferred alternative, sometimes limited resources go ignored, and people go with impulses before prudently calculating the availability of resources. One thing is in mind, and that is payoff.

Two pieces of resource-allocation research has distinguished the difference between the two expressions of objective function and subjective function. The M.A. thesis of Nolan (2000) examined resource-allocation behavior when the slope of the Objective Functions represented resource-allocation preferences. Participants were presented a resource-allocation problem in which the slope of the Objective Function was either equal to -1, -2 or -3. Results of this study indicated that participants did not make a clear distinction among the various slopes of the objective function presented.

A specific type of payoff, utility, can also determine how resource allocators' goals are represented by Objective Functions. Marty (2001) presented the meal problem to dyads composed of a Home Chef and a Restaurant Frequenter (refer to Ball et al., 1998 or Langholtz et al., 1997 for details of the problem structure). Each dyad member differed in meal preferences and utility received for home-cooked or restaurant meals. It was found that dyads who received opposing Objective Functions performed better than dyads who received the same Objective Function.

Payoffs can also be determined based on subjective valuation by the resource allocator. Resource allocators can develop subjective goals that extend beyond what is expressed by the Objective Function. It is proposed in this thesis that subjective goals can be distinguished from task goals in four ways in this thesis: First, subjective goals are anchored in the resource-allocation situation and emerge from subjective information provided by the scenario. Task goals, on the other hand, only pertain to resource-allocation problem factors. Second, subjective goals are deeply entrenched in the resource-allocation situation, whereas task goals are overtly expressed in the task instructions. Third, subjective goals can be represented by the Subjective Function, and task goals can be represented by the Objective Function. Finally, subjective goals can be different from task goals. The trajectory of the Subjective Function can differ from the trajectory of the Objective Function.

Complex Situations Might Require Planning

Do resource allocators simply jump into the resource-allocation problem, or do they think before they act? Cognitive strategies discovered by Ball et al. (1998) might point to a certain quality of spontaneity in resource-allocation decisions. The majority of participants (79%) in Ball's study were individuals who employed the Consume-and-Check (CAC) strategy, in which allocations were routinely varied throughout the task. In contrast, 21% of the participants employed the Solve-and-Schedule (SAS) strategy, in which the resource-allocation plan was established before the initial allocation. It is possible to assume that individual participants might be more inclined to be vigilant when making decisions and "check" resource availability as they go. However, this type of behavior might pertain more to individuals than groups. More deliberation might be

necessary for resource-allocation decisions in the present task than in the task presented in Ball et al. for three reasons: First, subjective information in the scenario might require more information processing of the resource-allocation situation in addition to the objective information of the resources. Second, the complexity of the present resource-allocation task involves three dimensions, which is more difficult than the standard two-dimensional problems that have appeared in most resource-allocation behavior literature. Third, when groups perform resource-allocation tasks, prior communication is essential before even the first transaction of resources.

Individual cognitive strategies found in Ball et al. (1998) may not be consistent with the strategies that must be employed to perform at an optimal level in the present experiment. When the task becomes more complex, more deliberation will be necessary to allocate resources appropriately. Therefore, decision makers in the present study may be more likely to employ the Solve-and-Schedule strategy (which requires a resource distribution plan) than the Consume-and-Check strategy (which does not involve a plan). Strategies for distributing resources in the present experiment will not be determined by verbal protocols as they were in Ball et al.'s study. Rather, presumptions of the strategies used are made, based on resource-allocation patterns that emerge or where there is variability in behavior. If obvious patterns emerge, it can be assumed that participants utilized the Solve-and-Schedule strategy. If patterns are varied or random, it can be assumed that participants utilized the Consume-and-Check strategy.

Overview

In the present study, resource-allocation performance and behavior is investigated from various perspectives of the resource-allocation situation. Principles of distributive

justice (i.e., equality, equity, and need) are represented in the present resource-allocation problem. The study will investigate to what degree people may distribute resources according to the social norms demanded by contextual information provided in three scenarios Equity, Equality, and Need. Since various perspectives of the resource-allocation situation are possible, characteristics of the resource allocators (i.e., individuals vs. groups, advocacy groups vs. neutral agency) are used to determine differences in decision-making by various agencies. The present study will investigate whether or not the bigger arsenal of cognitive resources that groups have compared to individuals will influence groups to perform better than individuals in resource-allocation tasks. Furthermore, groups and individuals are expected to attack resource-allocation tasks differently, where groups will use more SAS than CAC strategies. When personal stakes are at risk, groups comprised of individuals advocating divergent views are hypothesized to be inhibited by conflict, demonstrate the equal-scheduling tendency, and therefore perform at lower levels than groups comprised of members taking neutral perspectives.

METHOD

Participants played the roles of members of the TEA Corps, a fictitious non-profit organization that implements projects to aid three developing countries. The resource-allocation assignment was to utilize financial and personnel resources over the course of one year, and the humanitarian mission was to determine fair distributions of projects that accommodate the needs of each country.

Participants

Introductory psychology students at the College of William and Mary participated in the present study as part of a course requirement. The sample consisted of 150 participants who did not report previous experience in solving resource-allocation problems. Experimental conditions were based on scenarios provided on an interactive computer, and participants performed the resource-allocation task either as a three-person group or as individuals.

Apparatus

Introductory screens displayed on an interactive computer provided participants with instructions for performing the resource-allocation task. Each introductory scenario provided the context of the resource-allocation problem and presented the starting amounts of resources, the financial and personnel resources required for the implementation of each project, and the monthly project constraints. Following each monthly implementation decision, the screen displayed calculations of the number of projects allocated, the total of resources consumed, and the amount of resources

remaining in the year. Participants had the opportunity to evaluate their performance at the end of each year, when the computer screen displayed the summary of resource consumption and project implementation. Allocations were expunged at the end of each year, and computer program refreshed the resources to initial amounts for each trial.

Procedure

Participants played the roles of Project Directors for the TEA Corps, a mock non-profit organization that provides support for three developing countries—Tech Republic, Educaland, and Agraria—that require development in the areas of technology, education, and agriculture, respectively. Each participant read scenarios explicitly conveying the goal of the task: to maximize the number of projects possible to implement in one year when provided with a budget of $192,000 and 720 TEA Corps volunteers. Participants were not told with the optimal number of projects attainable, which was an IP solution totaling to 33 projects in the present resource-allocation problem.

Participants were told that at the beginning of each month, the TEA Corps implements new projects and complete these projects by the end of each month. As TEA Corps Project Directors, participants were given the opportunity each month to choose the location for project implementation and were provided with information about each project type with regard to each country's needs: technological projects provide the Tech Republic with computers, healthcare, and industry equipment; educational projects provide Educaland with the building of schoolhouses, teaching materials, and books; agricultural projects provide Agraria with planting crops, irrigation, and equipment. Among the project alternatives, technological projects required the most money but fewest volunteers; educational projects required intermediate amounts of money and

volunteers; and agricultural projects required the least amount of money but most volunteers to implement.

To ensure that resources were not consumed too early or excessively conserved throughout the year, project constraints were given to the participants. They were told that a minimum of one project and a maximum of five projects (any combination of the three countries) would be implemented each month. Finally, participants were directed to take the perspective consistent with the scenario provided.

Scenarios

While resource-allocation practices are found in various occupations and daily activities, they are usually so integrated into life's routines that cognitive procedures employed in resource-allocation tasks can be difficult to isolate in research. To facilitate the study of resource-allocation behavior, scenarios must be precisely crafted to convey the general context and unique circumstances embedded in the resource-allocation situation. Scenarios must be realistic enough for participants to understand the specifics of the resource-allocation problem, yet they need to be plausible and detailed enough for participants to identify with subjective aspects of the resource-allocation situation. To observe differences in behavior and performance among various resource-allocation situations, scenarios must be constructed so that they resonate with different takes or perspectives of the same resource-allocation problem presented. Resource allocators may not always see eye-to-eye when it comes to fairness judgments. Therefore, individuals with differing perceptions of fairness of the situation will be likely be diminished if a distribution norm is established (Mannix & White, 1992) and if qualitative distinctions of

the information is made available (Elliott & Meeker, 1986). The scenarios in their entirety are in the Appendix, but summaries of each scenario follow.

Equity Scenario. From an organization's perspective, economic productivity is one of the chief interests of the TEA Corps. Equity decisions are vital to this organization, and the importance of these types of decisions is promoted in this scenario. As a non-profit organization, the TEA Corps is not interested in profit; however, the Project Directors were charged with the responsibility to maximize the resources given each year. Participants were instructed to allocate resources in accordance with the business strategy of the TEA Corps organization. While the specific needs of each country were acknowledged in this scenario, participants were instructed to consider each country in the same regard. Further, participants were told that their decisions were to be based strictly on the costs of each project and available resources.

Equality Scenario. The TEA Corps generously offers projects to three countries: the Tech Republic, Educaland, and Agraria. To improve current conditions in each of these countries, the TEA Corps strives to adhere to the mission of providing them with as many project opportunities as possible. To maintain integrity as a nonpartisan organization, Project Directors were encouraged to view each country's need as legitimate and equally favorable. Instructed to maximize the implementation of projects, participants were also instructed to address the predicament of each country and to provide benefits to all three countries.

Need Scenario. As humanitarians and as part of an organization that provides aid for needy countries, TEA Corps Project Directors must be sensitive to the problems that developing countries face. Despite the justifiable needs of the Tech Republic and

Educaland, this scenario favored the perspective of the poorest country, Agraria. With the authority to respond to this impoverished country, Project Directors were given the opportunity to fulfill the moral obligation of assisting the campaign to end Agraria's famine. To this end, projects implemented in Agraria supplied the country with agricultural capabilities to provide its citizens with food. Participants who were given this scenario were faced with the dilemma either to maximize total projects among all three countries (the explicit goal of the task) or to address the desperate needs of Agraria.

Different perspectives scenario. Resource-allocation situations can be understood from various perspectives. Individuals affiliated with a country demonstrate allegiance to their nation, especially when in contention for scarce resources. In this scenario, citizens from the Tech Republic, Educaland, and Agraria represented their homelands as TEA Corps delegates. Acting as emissaries, participants were instructed to campaign for project implementation in their respective country. As members of the TEA Corps project committee, however, these representatives were told that they were accountable for maximizing the number of projects implemented each year. Based on negotiations and collaborative efforts, delegates were instructed to arrive at resource-allocation decisions appropriate to the complex situation.

Experimental Design of the Tasks

The primary goal of the present study is to determine if resource-allocation decisions and performance are solely based on the goal of achieving a maximum with the resource properties and structure of the resource-allocation problem or if the situational variables bias distribution decisions. There were two parts to the present experiment. First, a three-dimensional resource-allocation problem was presented to 120 participants.

Of these participants, 30 individuals and 30 three-person groups were divided into three treatment groups that solved the problem in contexts specific to three distributive justice principles (i.e., equity, equality, and need). In the present experiment, these contexts are referred to as the Equity, Equality, and Need scenarios. Hence, resource-allocation behavior and performance was examined using a 2 x 3 design in which groups were compared to individuals with respect to each of the three distributive justice scenarios.

In the second part of the experiment, 10 groups were composed of three individuals. Each individual in these three-person groups took on different perspectives of the resource-allocation situation. Each perspective advocated the Tech Republic's, Educaland's, or Agraria's point-of-view. All participants solved the three-optioned resource-allocation problem, which spanned 4 12-month years. Resource-allocation behavior of the participants who received the Different Perspectives scenario will be examined separately from the scenarios corresponding to the distributive justice principles of equity, equality, and need. The investigation of resource-allocation behavior in this scenario is for exploratory purposes.

In the analysis, a possibility of 50,400 data points can be included: 3 project sources x 12 months x 5 possible projects per month x 4 years x 10 individuals x 3 scenarios = 21,600; 3 project sources x 12 months x 5 possible projects per month x 4 years x 10 groups x 3 scenarios = 21,600; 3 project sources x 12 months x 5 possible projects per month x 4 years x 10 groups in the Different Perspectives Scenario = 7,200.

Three dimensional problem

Although participants were provided with scenarios that stressed different perspectives on the situation, the same basic mathematical three-dimensional resource-

allocation problem was presented to all participants. The dimensionality of the resource-allocation problem takes its form from viable alternatives. Participants were given three project alternatives in the areas of technology, education, and agriculture, thus producing a three-dimensional resource-allocation problem where Agraria represented the x-axis, the Tech Republic represented the y-axis, and Educaland represented the z-axis. Resource-allocation behavior is bounded by resource constraints, which are structured as planes in a three-dimensional space (see Figure 3).

TEA Corps project directors and delegates were provided with a yearly budget of $192,000 and 720 volunteers. Allocations of these financial and personnel resources were made each month for one year. Expenses required for the implementation of each project alternative were given to the participants, and these requirements are shown in Table 2.

Given the resource specifications, participants allocated their financial and personnel budgets to implement various combinations of projects within resource-constraints. The money constraint can be expressed as: $192{,}000 \geq \{8000T(x) + 4800E(x) + 4000A(x)\}$, where the numerical value to the left of the inequality represents the annual financial budget, and the numerical values on the right side of the inequality represent the money required to implement one project to the Tech Republic, Educaland, and Agraria respectively. Identically structured, the volunteer constraint line can be expressed as: $720 \geq \{15T(x) + 24E(x) + 30A(x)\}$.

The total number of projects implemented each month was regulated by project constraints. Participants were required to implement a minimum of one project and a maximum of five projects each month, but any combination of projects within these constraints were attainable. While project constraints are not required by integer

programming procedures, these restrictions were established to ensure that participants operated within the scope of the resource-allocation problem, in that TEA Corps projects were to be consistently implemented over the course of the year (not at one time). The project constraint can be expressed as $1 \leq T(x) + E(x) + A(x) \leq 5$, for $x = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12$, where x denotes the month of project implementation. In addition, a non-negativity requirement is imposed: $0 \leq T(x), E(x), A(x)$. Participants were also given the objective of maximizing the number of projects that can possibly be obtained in one year, and this objective can be expressed by the following Objective Function equation:

Maximize $p = \sum_{x=1}^{12} \{T(x) + E(x) + A(x)\}$, where the variable p represents the maximum total number of projects implemented in one year. This maximum of 33 may be obtained by any one of seven equally optimal solutions, (0, 8, 25); (0, 9, 24); (0, 10, 23); (1, 9, 23); (1, 10, 22); (2, 10, 21); and (2, 11, 20) found by the IP method (see Figure 4). $T(x)$, $E(x)$, and $A(x)$ represent the number of projects implemented for the Tech Republic, Educaland, and Agraria on month x.

Defined by the subjective function, resource-allocation scenarios contained persuasive arguments and steered participants toward different types of goals (other than simply maximizing the total number of projects) (see Panels B, C, and D of Figure 5 for each scenario presented). Participants that received the Equity scenario were instructed to maximize resources of money and volunteers. To facilitate the maximization of resources, the Equity scenario provided information regarding the number of resources available and the expenses involved in implementing projects to the three countries. For the complete utilization of all resources, the participant must implement exactly 32 projects: 16 for the Tech Republic, 16 for Agraria, and zero for Educaland. The

Subjective Function of the Equity scenario is expressed here in terms of the number of projects implemented in a year to obtain the Equity optimal solution of (16,16,0): $32 = 16T + 16E + 0A$.

The Equality scenario endorsed a cooperative environment, making the social implications of TEA Corps decisions very salient to participants who were instructed to regard each country as equivalent counterparts. To do so, the participant must implement exactly 30 projects, 10 for each country, in on year. The Subjective Function of the Equality scenario is expressed here in terms of the number of projects implemented in one year to obtain the Equality optimal solution (10, 10, 10): $30 = 10T + 10E + 10A$.

Participants that received the Need scenario were provided with information regarding the famine-affecting lives of Agrarian citizens, while no information regarding the status of Educaland and the Tech Republic were described beyond their basic needs (e.g., "Educaland needs help with schools"). For participants receiving the Need scenario, their Subjective Function is expressed as Maximize $a = \sum_{x=1}^{12} \{A(x)\}$, where the variable a represents the total number of Agrarian projects implemented in one year and a is obtainable by the Need optimal solution, (24, 0, 0).

Participants received exclusive information about the country they "represented" in the Different Perspectives scenario (see Figure 6). Each individual participant in the three-person groups that received this scenario their advocated country's own specific needs. Therefore, the Subjective Function defines the separate perspectives given to each group member. For the participant taking the Tech Republic's perspective, his or her Subjective Function is: Maximize $t = \sum_{x=1}^{12} \{T(x)\}$, where the variable t represents the maximum total number of Tech Republic projects implemented in one year, and where t

is possible if the Tech Republic optimal solution, (0, 24, 0), is obtained. The Subjective function for the participant taking Educaland's perspective is: Maximize $e = \sum_{x=1}^{12} \{E(x)\}$, where e represents the total number of Educaland projects possible to obtain the Educaland optimal solution, (0, 0, 30). The advocate for Agraria had the Subjective Function: Maximize $a = \sum_{x=1}^{12} \{A(x)\}$, where a represents the total number of Agraria projects at Agraria's optimal solution, (24, 0, 0).

RESULTS

Resource-allocation Performance

Obtaining z and Optimal Solutions.* Participants were instructed to obtain their goal for maximizing the number of projects in one year while maintaining their subjective goals respective of the resource-allocation situation they were given. By maximizing the number of possible TEA Corps projects, participants could obtain z*, which represents 100% of the optimal IP solution. Percentage of z* denotes performance and is calculated by dividing the number of projects obtained (endpoint at the conclusion of the twelfth month of the year) by the maximum number of projects possible (z*), given the resource constraints. Failure to maximize the number of projects indicates that performance was not optimal; therefore, any percentage less than 100% of z* (e.g., 90% of z*) represents sub-optimal performance. The optimum LP solution is (0, 9.6, 24), where *x, y, and z* are equal to the number of projects in Agraria, Tech Republic, and Educaland, respectively. Since solutions cannot be in fractional form, LP solutions are not used to compare performance. In the present resource-allocation problem, participants could obtain 33 projects. Using the IP method, there were seven IP optimal discrete solutions: (0, 8, 25); (0, 9, 24); (0, 10, 23); (1, 9, 23); (1, 10, 22); (2, 10, 21); and (2, 11, 20). These seven IP solutions illustrated in Figure 4 are the only solutions that can be obtained in which 33 TEA Corps projects are implemented.

Fundamentally, the seven IP solutions are the normative solutions of the resource-allocation problem. In the present resource-allocation problem, the attainment of any of

the IP or normative solutions is an indication that the number of projects was maximized. Provided with the goal to maximize projects in a specified direction, resource allocators can obtain an optimal solution if that goal is fulfilled. For example, resource allocators that have an explicit intention to distribute projects equally among recipients might do so successfully, thereby obtaining the optimal solution designated for that goal. In sum, the most favorable optimal solution is the measure by which goal achievement can be observed.

Scenarios. The resource-allocation scenario determines how groups and individuals will distribute projects and resources. Resource-allocation performance differed significantly overall, depending on the resource-allocation scenario provided, F (2, 234) = 3.136, p = .045. Participants who received the Equity scenario obtained 93% of z* on average and performed better than participants who received other scenarios (see Figure 7). Participants who received the Equality scenario obtained 92% of z*, and those who received the Need scenario obtained 91% of z*.

Also determined by z*, resource consumption can be an indicator of conscientious monitoring of money and volunteers in the present study (see Figure 8). Overall, optimal consumption rates for money differed with respect to the resource-allocation situation provided, F (2, 234) = 8.759, p = .000, but consumption rates for volunteers did not differ significantly according to scenarios.

Groups vs. Individuals. Groups were compared to individuals on overall performance, but no significant difference was found. Groups obtained 93% of z*, while individuals obtained 92% z*.

Groups were compared to individuals on the consumption rate of money and volunteers. Groups and individuals did not differ significantly on consumption rates of either money or volunteers. Groups obtained 89% of z*, and individuals obtained 88% of z* for money, $F(1, 234) = 1.068$, $p = .305$, and both groups and individuals obtained 98% of z* for volunteers, $F(1, 234) = .009$, $p = .924$.

Learning. Over time and with practice, resource allocators can improve performance by learning how to utilize resources and maximize projects each year. A resource summary screen appeared at the end of each year, which gave participants an opportunity to evaluate their choices and adjust their allocation schemes in order to reach their goals. However, participants did not demonstrate performance-learning patterns throughout the four years. They did not show a significant increase in the attainment of the IP optimal solution. Participants learned how to better maximize money, $F(3, 162) = 1.70$, $p < .05$ (see Figure 9), but not volunteers over the four years that they implemented projects.

Squandering Behavior

Resource allocators were given one year (i.e., 12 months) to implement as many projects as possible using the resources available, with the stipulation that a minimum of one project and a maximum of five projects were to be implemented each month. Any combination of the three types of projects was possible. For example, resource allocators could implement five projects to Educaland and zero projects to the other two countries.

The minimum and maximum provisions were made so that participants would not be inclined to consume too early and have no resources remaining at the end of the 12-month period (i.e., squandering) or postpone consumption too much and have an abundance of resources remaining at the end of the year (i.e., hoarding). Despite these restrictions, resource allocators demonstrated squandering behavior overall, F (11, 594) = 45.171, p = .000. Projects were implemented consistently less each month, from a mean of 3.5 projects in the first month to a mean of 1.69 projects at the end of the twelfth month. Moreover, groups and individuals demonstrated different levels of squandering behavior. As shown in Figure 10, individuals squandered more than groups during the first six months, but groups squandered away more projects during the last six months, F (11, 594) = 3.886, p = .000. The resource-allocation scenario manipulation did not have an effect on squandering behavior; therefore, the month by scenario interaction was not significant, F (22, 594) = .389, $p > .05$.

Over the 12-month period, participants as a whole squandered their money, F (11, 594) = 33.83, p = .000, and volunteers, F (11, 594) = 48.933, $p < .001$ (see figure 11). During the first six months, individuals were less conservative than groups, but groups expended their resources more than individuals during the last six months (see Figure 12). There was a significant difference between group and individual money-squandering behavior, F (11, 594) = 3.780, $p < .001$, and volunteer-squandering behavior, F (11, 594) = 3.780, $p < .001$.

Resource-allocation Behavior

The closer resource allocators are to 100% of z*, the greater level of their performance on the task. However, the complete assessment of resource-allocation

behavior cannot be examined exclusively in this particular mathematical form. As demonstrated earlier, the resource-allocation situation had an effect on performance because the obtained percentages of z* differed significantly among groups receiving dissimilar scenarios. Regardless of the percentage of z* obtained or performance on the task, behavioral differences in resource-allocation can be revealed. Resource-allocation behavior is customarily examined by using the graphical solution method. The illustrations used in the simplex method facilitate the conceptual understanding of resource-allocation behavior, and differences among comparison groups are visually depicted.

In previous studies of resource-allocation, differences in behavior were determined to be the result of resource changes and fluctuations, and endpoint solutions (at the end of the year) were interpreted as a percentage of z*. In the present study of resource-allocation, differences in behavior were ascertained by examining various manipulations of the situation driving resource-allocation decisions. Endpoints plotted for each scenario task condition are shown visually in Figure 13. The conceptualization of these endpoints in a three-dimensional space is imperative because the variability among these endpoints within and between each condition is determined by how far endpoints extend down the *x*-, *y*-, and *z*-axis.

Distributive outcomes. Panel A, Figure 13 is an illustration of the endpoints for participants who received the Equity scenario. Overall, the ranges of endpoints (i.e., the combination of projects implemented to Agraria, the Tech Republic, and Educaland in one year) extended from 6-16 projects on the x-axis (representing Agraria), 6-18 projects on the y-axis (representing the Tech Republic), and 2-15 projects on the z-axis

(representing Educaland). The mean endpoint in the Equity scenario condition was (10, 11, 11).

Panel B of Figure 13 shows the endpoints for participants who received the Equality scenario. The overall ranges of endpoints were narrower than the ranges in the Equity scenario: 7-16 projects implemented in Agraria, 5-15 projects implemented in the Tech Republic, and 7-12 projects implemented in Educaland. The mean endpoint in the Equality scenario condition was (10, 10, 10).

Panel C, Figure 13 exhibits the large variability of endpoints for participants who received the Need scenario. Projects implemented in the scenarios ranged from 6-16, 6-16, and 3-16 in Agraria, the Tech Republic, and Educaland respectively. The mean endpoint in the Need scenario condition was (12, 9, 9).

Panel D, Figure 13 demonstrates the variability of endpoints for participants who received the Different Perspectives scenario. Each member of the group that received this scenario were advocates for Agraria, Tech Republic, or Educaland, and ranges of projects for the three countries were 6-14, 7-14, and 5-13 respectively. The mean endpoint for participants in Different Perspectives scenario condition was (10, 11, 10).

Comparing resource-allocation alternatives. While the graphical method is a suitable technique to explore resource-allocation behavior (see Figure 14), the differences among comparison groups can also be examined statistically. Each receiving one of the three distributive justice scenarios, groups were compared to individuals on their initial and final project selections, represented by point (x, y, z). Initial project implementations differed significantly between groups and individuals in this 2 (resource allocator type) x 3 (resource-allocation scenario) MANOVA, $F(3, 232) = 5.07$, $p = .002$. The mean initial

project selection was at point (1.48, .8, and .942) for groups and at point (1.77, .892, 1.09) for individuals.

According to the scenario provided, significant differences were found among the three resource-allocation situations, F (6, 466) = 3.49, p = .002. Participants' initial selections were at point (1.39, 1.04, 1.06) for those who received the Equity scenario, at point (1.6, .75, 1.13) for those who received the Equality scenario, and at point (1.89, .75, .862) for those who received the Need scenario.

A significant interaction was found between resource allocator types and scenario conditions, F (6, 466) = 3.49, p = .04. While initial project implementation differed depending on the scenario provided, individuals implemented significantly more projects in the first month than groups did. When participants reached the final project implementation period, groups and individuals no longer differed in endpoints. However, scenarios still had a significant effect on project implementation at Month 12, F (6, 466) = 11.627, p = .03.

Final endpoint solutions differed significantly among participants in the resource-allocation scenarios, F(6,466) = 11.627, p = .000. Participants in the Equity scenario reached an endpoint of (11,10,10), and participants reached endpoints of (10,10,10) and (12,9,9) in the Equality and Need scenarios respectively.

Over the course of the 12-month resource-allocation task, the trajectory of behavior changed considerably. The difference between initial implementation point and final implementation point among groups were significantly different significantly from these points for individuals, F (1, 234) = 7.05, p = .008. The initial and final

implementation points also differed significantly depending on the resource-allocation scenario, $F(1, 234) = 3.224$, $p = .042$.

Equal-scheduling Tendency. The propensity for equal outcomes in resource-allocation behavior has been defined as the equal-scheduling tendency. For example, the total number of projects implemented to Agraria, Educaland, and the Tech Republic at the end of the year is equal. In previous two-dimensional resource-allocation problems, the slope of the line drawn from the origin to the endpoint has determined the equal scheduling tendency. If the slope is close to +1, then the participant exhibited the equal-scheduling tendency. Overall, participants in the present study exhibited the tendency to distribute projects equally among the three countries, as the average final solution endpoint was ($M_A = 11$, $M_T = 10$ $M_E = 10$). While equal outcomes can be assessed at the end of Month 12 by examining slope, the equal-scheduling tendency has not been examined in the interim, from when the year began and when the year ended. Means of projects implemented to the three countries were combined at Month 1 and Month 12 to obtain overall means of projects distributed over the course of the year ($M_A = 6.20$, $M_E = 5.28$, $M_T = 5.49$). These means for Agraria, Educaland, and the Tech Republic were significantly different, $F(2, 233) = 32.116$, $p < .001$. The implementation of projects to Agraria, Educaland, and the Tech Republic changed from Month 1 to Month 12, and this interaction was significantly different, $F(4, 468) = 17.47$, $p < .001$. Thus, while participants demonstrated the tendency toward equal outcomes, they did not distribute projects equally among the three countries consistently throughout the task.

The resource-allocation scenario was a driving force for determining whether or not to maintain an equal distribution throughout the task. An interaction was found

between scenario type and project type implemented, F (4, 468) = 17.466, $p < .001$. Participants who received the Need scenario demonstrated behavior most inconsistent with the equal-scheduling tendency ($M_A = 7.00$, $M_E = 4.78$, $M_T = 5.01$), in comparison to participants in the Equity scenario ($M_A = 5.61$, $M_E = 5.61$, $M_T = 5.93$) and the Equality scenario ($M_A = 5.98$, $M_E = 4.46$, $M_T = 5.54$). Moreover, the scenario had an effect on the implementation of projects to each of the three countries from Month 1 to Month 12, thus producing a three-way interaction, F (4, 468) = 11.87, $p < .001$.

DISCUSSION

In a world where people, time, and money are important and scarce resources, good resource-allocation decisions are crucial. Efficiency, timeliness, and payoffs are only a few outcomes that can come from a good resource-allocation decision. However, what makes a resource-allocation decision a "good" one – a decision where the optimal IP solution is obtained, where justice is found, where a group is in agreement, where instructions are followed? Resource-allocation decisions can be based on a multitude of factors, and many of these factors often occur simultaneously. Resource allocators can overcome complexity of these decisions, as shown in the performance by many of the participants. In this and previous studies on resource-allocation behavior, resource-allocation decisions were assessed on performance (i.e., the percentage of z* obtained) and patterns in behavior that develop over time (i.e., plotted with the Graphical Method).

Obtained distribution solutions compared to the normative IP solution

Maximizing or making the most out of the resources? One example of a dilemma faced by product consumers is the decision of whether to buy products in bulk or in individual packages. When products are purchased in bulk, the enormous quantity of the product can be overwhelming and may not be completely utilized. However, when products are purchased in quantities of exact amounts desired, resources are maximized to their potential. Similar to the consumer's decision of either buying products in bulk or in smaller separate quantities, inputs into the present study's resource-allocation system involved two types of estimation: (a) resources needed to achieve a maximum number

projects or (b) the optimal combination of projects that can maximize resources. The percentage z* obtained was the measurement used to obtain the first type of estimation and determined the level of performance. Resource allocators in the Equity scenario achieved 93% of the optimal IP solution. The performance level of these resource allocators was higher than the performance of resource allocators in all scenarios, or participants in the Equity scenario implemented more projects that participants in the other scenarios. Because the Equity scenario invoked a salient rule of maximization, the observed resource-allocator performance was consistent with this goal of the task. A cautionary note should be made about the distinction between maximizing projects and maximizing resources, however. Although participants in the Equity scenario demonstrated better performance than participants in the other treatment groups, better performance (obtaining a final endpoint closest to the optimal solution of (0,9.6,24)) was not an indication of better resource maximization (obtaining a final endpoint closest to (16,16,0)). Participants did not make the distinction between the two types of inputs into the resource-allocation system.

Obtaining social harmony instead of the IP solution. In cooperative settings, the cultivation of relationships and social harmony are central to making quality decisions. In the Equality resource-allocation situation, quality decisions are assessed by the fairness of the distribution. However, decisions based on the resource-allocation problem are assessed in quantitative terms. Since resource-allocation performance is assessed by z*, quantity is more relevant than quality in this respect. Participants who received the Equality scenario obtained 92% of z*. Perhaps sub-optimal performance can be interpreted by the construed consequences that resource providers would have faced if

decisions were unjust. While optimal IP solution was attainable, participants made decisions based on equal distribution outcomes. Equivalent distribution among the three countries could imply the influence of two biases that involve either (a) the equal-scheduling tendency or (b) the effect of the context presented to the participants. Given the Equality scenario presented to participants, however, the distinction would be difficult to make. While the equal-scheduling tendency is commonly used in resource-allocation, participants were also instructed to make equal distributions among the three countries. Further, while participants in the Equity scenario demonstrated the equal-scheduling tendency, resource-allocation behaviors observed in the Need scenario were driven more by the context than by the equal-scheduling tendency. Hence, performance by participants in the Equality scenario can be interpreted in two ways depending on which reference point is used to compare behavior.

Humanitarian considerations vs. rational decision-making. As shown in games research, the distribution of resources according to ethical principles does not necessarily correspond to rational decision criteria (Pepitone, 1971). When all resource recipients are in disadvantaged positions, it would be morally inappropriate to ignore the needs of everyone affected by the distributive decisions. Therefore, participants receiving the Need scenario did not demonstrate optimal performance and perhaps catered to the needs of the developing countries by obtaining 91% of z*. Although these participants demonstrated inferior performance compared to other participants who received the other scenarios, the sub-optimal performance could be a justification for in their resource-allocation situation presented to these participants

Sacrificing individual goals for group goals. Negotiation among groups involves the maintenance of personal goals while preserving cooperation to reach agreement among group members. The attainment of an optimal solution can be sacrificed when individuals perceive situations differently and must negotiate their own stake for resource claims (Hyder, Prietula & Weingart, 2000; White, 1992). Hyder et al., (2000) demonstrated that some aspects of negotiation inhibit negotiators to achieve optimal solutions to the problem. Participants in the current study were asked to use substantiation, or arguments either made to support one's own position or to attack the other party's position in attempt to persuade the other party to shift their position, to reach a distributive solution. This solution was compared to the optimal IP solution to obtain 97% of z*. This good though sub-optimal performance might be explained by the participants' use of substantiation in negotiating an overall distributive outcome.

Contexts driving resource-allocation decisions

Particularly from this distributive justice perspective, the thrust behind allocation decisions does not simply come from resource availability and costs, but emanate from the contexts in which problems are presented. With multiple constraints or in multiple dimensions, the resource-allocation problem space is complicated and puzzling enough. With added situational variables that exceed the frontiers of the problem space, resource-allocation decisions become even thornier, unless direction is provided by the context. By examining these decisions with a distributive justice agenda, resource allocators can evaluate the situation in terms of equality, equity, or need and make decisions based on these principles.

One of the new aims of resource-allocation research, therefore, is to disentangle the knot of key elements (i.e., characteristics of the resource-allocation situation, the resource allocators, and the problem) that drive distributive decisions. In many resource-allocation studies, performance (i.e., percentage of z* obtained) has been the primary variable examined. Perhaps, the observation of general performance is an excessively myopic research question to consider. Broader aspects of resource-allocation behavior are emerging out of the current research. Rather than solely examining the question of how close people are to attainment of optimal IP solutions, the behavior over time and final endpoint solutions can be clarified by the situational circumstances in which resource allocators find themselves. When examined through the lenses of various contexts, specific behaviors have been identified as manifestations of distributive justice concerns.

Resource-allocation behaviors can be extricated from contexts facilitating the interests in economic productivity, positive social relations, and physiological well-being. These situational variations inherently solicit certain distributive outcomes. Moreover, the implementation of various distributive justice principles can be ascertained by the proximity of final endpoint solutions in each scenario.

Are resource providers also resource maximizers? Resource allocators who received the Equity scenario were instructed to maximize their resources of money and volunteers and obtained a mean final endpoint of (10*A*, 11*T*, 11*E*). If Equity Subjective Function were utilized, the optimal solution for this scenario would be at (16*A*, 16*T*, 0*E*). While these expected and obtained solutions comprise the same number of total projects implemented overall (i.e., 10 + 11 + 11 = 16 + 16 + 0 = 32 total projects), there was money left remaining ($11,200) in the participants' obtained mean solution. Participants

did not completely expend all their resources to obtain the optimal solution (where $0.00 and zero volunteers are left remaining). Resources that were not consumed were left as waste and could not be salvaged once the year terminated. Therefore, resource allocators in the Cost-effective scenario did not behave as directed by their Subjective Function to utilize all resources available.

The most apparent explanation for the discrepancy between the expected solution and the obtained solution was that the equal-scheduling tendency was followed. Resource allocators who received the Equity scenario nearly balanced project implementations in Agraria, Educaland, and the Tech Republic. This behavior is similar to previous resource-allocation studies where participants exemplified the use of the equal-scheduling tendency. Equal distribution is not only a simple cognitive heuristic to use, but it also develops as a guard for uncertainty. Financial consultants and stockbrokers, for example, typically advise clients to "diversify" portfolios to protect themselves from losses that can potentially be incurred if individual market sectors take a downward turn. Likewise, the implications for ignoring the needs of the three deprived countries might be greater than the repercussions for inefficiently allocating resources.

The politics involved in some resource-allocation decisions can weigh on the conscience of resource providers as they seek consistency with standards of the social or organizational environment (Surazska, 1986). The resource-allocation process does not end once a decision is made; decisions are evaluated by the recipients, superiors, and the public in general. Should resource providers ignore the needs of Educaland, simply because resources will be maximized if a certain solution (i.e., (16*A*, 16*T*, 0*E*)) is obtained? Perhaps the equal distribution of implemented projects was a result of a

diplomatic decision, rather than a futile attempt at maximizing resources. Nonetheless, in the Equity scenario, resource providers chose to be sensitive to rather than to ignore each of the countries' needs (including Educaland's).

Resource providers given the Equity scenario were provided with limited information regarding the status of the countries. This procedure was executed to ensure that participants would base decisions more on resource properties than the needs of the countries. However, an incomplete depiction of the resource-allocation situation could also warrant the use of the equality heuristic, which is a quick and easy cognitive shortcut to carry out.

A context that justifies the equal-scheduling tendency. The equal distribution of TEA Corps projects among recipients exists as a fairness heuristic that resource providers can rely on without trouble. Resource allocators who received the Equality scenario were instructed to meet the requests of Agraria, Educaland, and the Tech Republic. In so doing, participants reached their goal to maximize the number of projects possible, while maintaining an equal proportion of projects implemented. They obtained a mean final endpoint of (10*A*, 10*T*, 10*E*), which is the optimal solution consistent with the details provided in the Equality scenario.

As an organization that provides financial aid and manpower assistance, the TEA Corps must make decisions with objectivity and impartiality. While Agraria, Educaland, and the Tech Republic each have their own state-of-affairs, the Equality scenario directed resource providers to regard each country as equivalents and legitimize the needs of each country. With the given instructions, equalizing project implementations among the three countries appears to be an effortless task; balanced outcomes are easily achieved.

Anomalous behaviors were observed, however. Resource-allocation behavior still varied among resource providers in the Equality scenario, despite its explicit instructions to maintain a neutral stance. Variability among resource allocators can be accounted for by examining resource-allocation behavior at each year. Participants were aware that new project implementations recurred every year and that resources were refreshed to their initial amounts once the computer program completed one cycle. A few participants demonstrated variability in their project distribution in the first year (e.g., (15*A*, 8*T*, 8*E*)), switched the direction of distribution the following year (e.g., (8*A*, 15*T*, 8*E*)), and so forth. Projects were not always implemented equally during a given year, but participants who managed the problem in this way eventually balanced overall outcomes by the time they finished with the fourth year of the task.

Addressing the concern for humanitarian action. As members of a charitable organization and characterized as compassionate, benevolent human beings, TEA Corps Project Managers had control and authority over the implementation of the projects. It was up to the resource provider's prerogative to allocate resources based on their own set of standards or conditions. It was expected that resource providers would view Agraria as the most disadvantaged of the three countries. Evident in the final distribution outcomes of project implementation, participants in the Need scenario found that the (12*A*, 9*T*, 9*E*) IP solution was the proper response to the distributive justice principle of need. The marked asymmetry in the solution is an indication that project directors distinguished the special needs of Agraria from the needs of the other countries. Agraria endures a more brutal class of penury — starvation — in comparison with the Tech Republic's need for technological advancements and Educaland's need for acceptable learning environments.

Although participants could have taken a more disproportionate venture (i.e., by obtaining a solution of (24*A*, 0*T*, 0*E*)), participants who received the Need scenario remained sensitive to the needs of the other two countries. Hence, resource providers made decisions more moderate than was expected (i.e., according to a Rawlsian (1971) perspective for improving the situation of those worse off) and did not obtain the IP solution directed by their Subjective Function.

Sub-optimal behavior, as observed in the Need scenario, can be explained by the potential accountability that people face when making judgments and decisions. In social and organizational environments, the goals that steer the decision-making derive from the motivation to enhance one's social image and to maintain the approval and respect for others (Tetlock, 1985). Moreover, decision-makers take explicit responsibility for the welfare of others and enforce their own political ideologies (Clayton, 2000; Mannix et al., 1995; Rasinski, 1987). As authoritative figures with control over the welfare of three developing countries, project directors considered each issue in its own right. Although the conditions were relatively more deprived in one country than the other two, the overall concern for distributive justice cannot be disregarded because the integrity of the TEA Corps organization could be challenged. If resource providers implemented projects only in Agraria, would the citizens of Educaland and the Tech Republic be tolerant of this decision? Although the severity of Agraria's plight extended to health and physical well-being, there was also a sense of responsibility to meet the requests of other countries. Therefore, participants who received the Need scenario took on a genteel perspective of the situation by distributing resources to all three alternatives, rather than obtaining an All-and-Nothing solution, where Agraria would receive all TEA Corps projects. Hence,

morally appropriate criteria were used for the distribution outcome because all countries deserved consideration, and this context emphasized the minimization of suffering in general.

Justifying one's deservingness in relation to others. The distribution of goods in society has been concerned with the recipient's responses to injustice or inequality. Early social justice research (e.g., Thibaut & Kelley, 1959) heralded the interest of perceived fairness of distributive outcomes and reaction to these outcomes. Fairness judgments are often evaluated on the social level, rather than on the individual level, by comparing one's relative standing against another's (Festinger, 1954). When individuals in groups use one another as a measuring stick for social comparison, they are particularly sensitive to the notion of injustice, a feeling that consequently provokes dissatisfaction with or antipathy for the distributive outcomes. Blatant inequality in the distribution share warrants social comparison judgments of deservingness. Most of the theoretical underpinnings of social comparison processes have focused on various dimensions such as abilities and opinions; however, comparison judgments of deservingness in the context of distributive justice have tapped little into research and theory (Bazerman et al., 1995; Masters & Smith, 1987), and have not been addressed in resource-allocation behavior.

To some extent, compliance with the benchmarks of fairness stems from the need to perceive oneself as a deserving person (Reis, 1981). Presented with information regarding their respective country, Agraria, Educaland, and Tech Republic delegates contended for TEA Corps project implementation: Agraria delegates maintained that the health of their citizens was at stake; Educaland delegates declared the need for securing the intellectual well-being of their children; and the Tech Republic delegates upheld their

case for advancing industrial interests. As advocates, each delegate claimed deserved consideration for the implementation of projects. As a conglomerate, however, the group was charged with the responsibility for negotiating outcomes with their counterparts. Overall, the group consensus was to distribute projects evenly among the three countries. Resource allocators took on different perspectives of the situation and settled on the distribution of 11 projects to Agraria, and 10 projects each to Educaland and the Tech Republic. Two conclusions can be derived from these results. Perhaps the needs of these countries were equally deserving and defensible in regards to the receipt of aid from the TEA Corps organization. Alternatively, cooperation in reaching a consensus may have taken precedence over engaging in a prolonged dispute. While the former explanation serves as a manipulation check on deservingness among the three countries, the later account epitomizes the means by which groups typically reach decisions.

Justice judgments from the decision-maker's perspective

Business managers, social service workers, and university administrators alike have goals to maximize the productivity within the organization for which they manage while maintaining a positive, cooperative environment. The suitable approach for distributive decisions made by authoritative figures in organizational environments would include the merging of equity, equality, and need (Mannix, Neal & Northcraft, 1995; Tyler & Griffin, 1991). The three types of distributive justice do not always emerge as distinct entities and cannot be extricated easily from most situations and social contexts. These principles are often observed as a composite of fairness issues, and the differing yet interacting goal options (e.g., maintain equity while remain compassionate for the needy) are difficult to balance. Although the major difficulty is that group members must

agree upon an acceptable distribution norm (Mannix et al., 1995), authorities can identify the positive outcomes for making allocation decisions by means of fair procedures (Tyler & Griffin, 1991).

Fairness judgments over time

Distributive outcomes are generally examined once a final decision is made. However, one of the advantages of research in resource-allocation behavior is that fairness judgments can be assessed and compared at many points in time. In the current study, distributions were observed on a monthly and yearly basis. From the incremental surveillance of behavior, final IP endpoints determine final distributive outcomes. Participants did not always behave consistently throughout the task. Their overall behavior assessed at each month demonstrated squandering, and even more so for individuals than groups (contrary to the risky-shift phenomenon). When behavior was examined after each year, however, there were no significant changes in distributive outcomes overall. Bazerman et al. (1995) emphasized that discrepancy between one-at-a time evaluations (i.e., take-it-or-leave-it) and comparative evaluations of fairness have ecological ramifications. How assertive or impulsive must one be to make proper judgments of fairness? While iterative tasks (one-time decisions) were not compared to dynamic tasks (decisions over time) in the current study, previous research in resource-allocation behavior indicate that there could be differences (i.e., learning effects).

Future distributive justice considerations in group resource-allocation behavior

It would be an intuitive assumption that resource allocators working in groups will encounter more difficulty in implementing distribution rules than individual resource allocators if allocation goals were not made explicit. Processing the information and

making fairness judgments is a complex task. Compounded with idiosyncratic approaches and judgments from other individuals in the group, the difficulty of the task is even more amplified. Decisions by groups trying to reach agreements on distribution rules to employ can also be hampered by unspecific guidelines for distribution (Mannix et al., 1995). Therefore, it was necessary to provide participants with a "frame of mind" for the resource-allocation task.

Derived from each of the scenarios implying various distribution norms, resource-allocation situations could be assessed independently of the resource-allocation problem itself. Similar to the findings of Harris and Joyce (1980), participants have a tendency to differentiate between the allocation of expenses and the allocation of outcomes. However, the results of current study indicate that participants preferred to make resource-allocation decisions based on the distributive outcomes than based on resource properties (i.e., availability, costs, etc.). Perhaps the distributive outcomes are more salient that quantifiable aspects of the resources. This cognitive tendency can be further examined in resource-allocation behavior by manipulating the inputs (e.g., projects vs. resource amounts) into the resource-allocation system.

Competing concerns in resource-allocation

Notions of distributive justice, as investigated in the present study, were conceptualized as independent allocation schemes and have been examined separately throughout the distributive justice literature (e.g., Boldero & Rosenthal, 1980; Deutsch, 1975; Mannix et al., 1994; Walster et al., 1976). However, the resource-allocation behavior of participants indicates that they were aware that various allocation procedures could be implemented to obtain a satisfying solution. None of the resource allocators

diverged to any complete extreme (e.g., obtaining a distribution solution of (0, 9, 24)), even when the resource-allocation problem necessitated that one of the seven IP solutions must be obtained to achieve maximization. While the results indicate that they were swayed by the imposed context in which the problem was presented, there was not much variability in their obtained solutions, in relation to the vast feasible region where hundreds of solutions were possible. The uniformity in behavior can be attributed to the competing concerns of equality, equity, and need, the three components of distributive justice that are conceptually different but difficult to examine discretely. An attractive facet of resource-allocation behavior is that inputs into the system are easily assessed and that distributive rules can be interpreted from the final solutions obtained. Therefore, the complexity of resource-allocation analysis is mitigated by the behaviors that emerge from the three distribution norms.

Extrapolating from unique distributive justice conditions

By examining allocation decisions with a distributive justice framework, the situational variables surrounding resource-allocation problems can be identified. What makes resource allocators inspect the problem space in the way they do? The manner in which the problem is presented and how the situation is depicted considerably accounts for variability in behavioral patterns (Harris & Joyce, 1980). As observed in the present study, contextual manipulation allows researchers to control for environmental aspects driving specific types of resource distribution. Distribution of resources, however, should also be examined outside of the laboratory. In natural settings, resource providers understand the importance of justice to the recipients and actively mold their allocation policies to conform to distributive justice principles (Lerner & Lerner, 1981). Some

researchers have argued that issues of distributive justice should be examined according to the extent to which the principles are defined by resource allocators, rather than by the observation of how people react to the principles under various circumstances (Tyler & Griffin, 1991).

The empirical work on distributive justice has taken an approach to examine fairness judgments on the part of the provider and recipient independently. By investigating distributive justice as a broader concept, the interaction between fairness judgments from the perspectives of both the provider and recipient can better determine the source of distributive outcomes. For example, the integrity of decisions made by the provider (e.g., a social worker) is evaluated based on the best interests of the recipients (e.g., orphaned children). Considering fairness judgments on the part of the providers and perceptions of the recipients simultaneously can further expand distributive justice research.

Conclusions

What was once a well-defined research-allocation problem has now become an ill-defined distributive justice problem. The frontiers of resource-allocation research are expanding beyond the examination of resource fluctuations and properties. Various allocation schemes that have long been identified in the distributive justice literature are finally emerging as interpretations for resource-allocation behavior. The current research demonstrated that distributive justice issues can have a bearing on resource-allocation performance. More importantly, contexts were shown to affect judgments profoundly. The resource-allocation contexts and situations as presented in this study specifically focused on distributive justice issues, and it is also acknowledged that circumstances in

which people make resource-allocation decisions are not solely based on fairness issues or distributions among resource recipients.

Based on the present research investigation in resource-allocation behavior, it can be concluded that resource providers will be able to pick up on clues from the resource-allocation environment and follow instructions; they will be able to determine which resource-allocation scheme is best to use; they are able to distinguish these resource-allocation schemes whether in groups or as individuals; and they obtain a distribution outcome that will be "fair" according to the resource-allocation situation.

TABLE 1
Experimental Design of Three-dimensional Resource-allocation Problem

	Distributive Justice Scenario			Other Scenario
	Equity	Equality	Need	Different Perspectives
Project Sources	3	3	3	3
Number of Months	12	12	12	12
Possible Projects	5	5	5	5
Number of Years	4	4	4	4
Participants				
Individual	10	10	10	
3-Person Group	10	10	10	10

TABLE 2
Money and Volunteers Required to Implement Each TEA Corps Project

	Resources	
	Money	Volunteers
Tech Republic	$8000	15
Educaland	$4800	24
Agraria	$4000	30

Figure Caption

Figure 1. Resource-allocation problems can be presented in multiple dimensions. In a three-dimensional problem, each dimension represents a decision variable on the *x*-, *y*-, or *z*-axis. Resource constraints are represented by three-dimensional planes (*x*-, *y*-plane; *y*-, *z*-plane; *x*-, *y*-plane), which determine the boundaries of the feasible region. Any point can be satisfied in this feasible region that is restricted by the shaded resource-constraint planes. The "most attractive corner," is a maximum point in the feasible region that can be satisfied within the resource-constraints and represents the optimal solution if the goal of the resource allocator is to maximize payoffs.

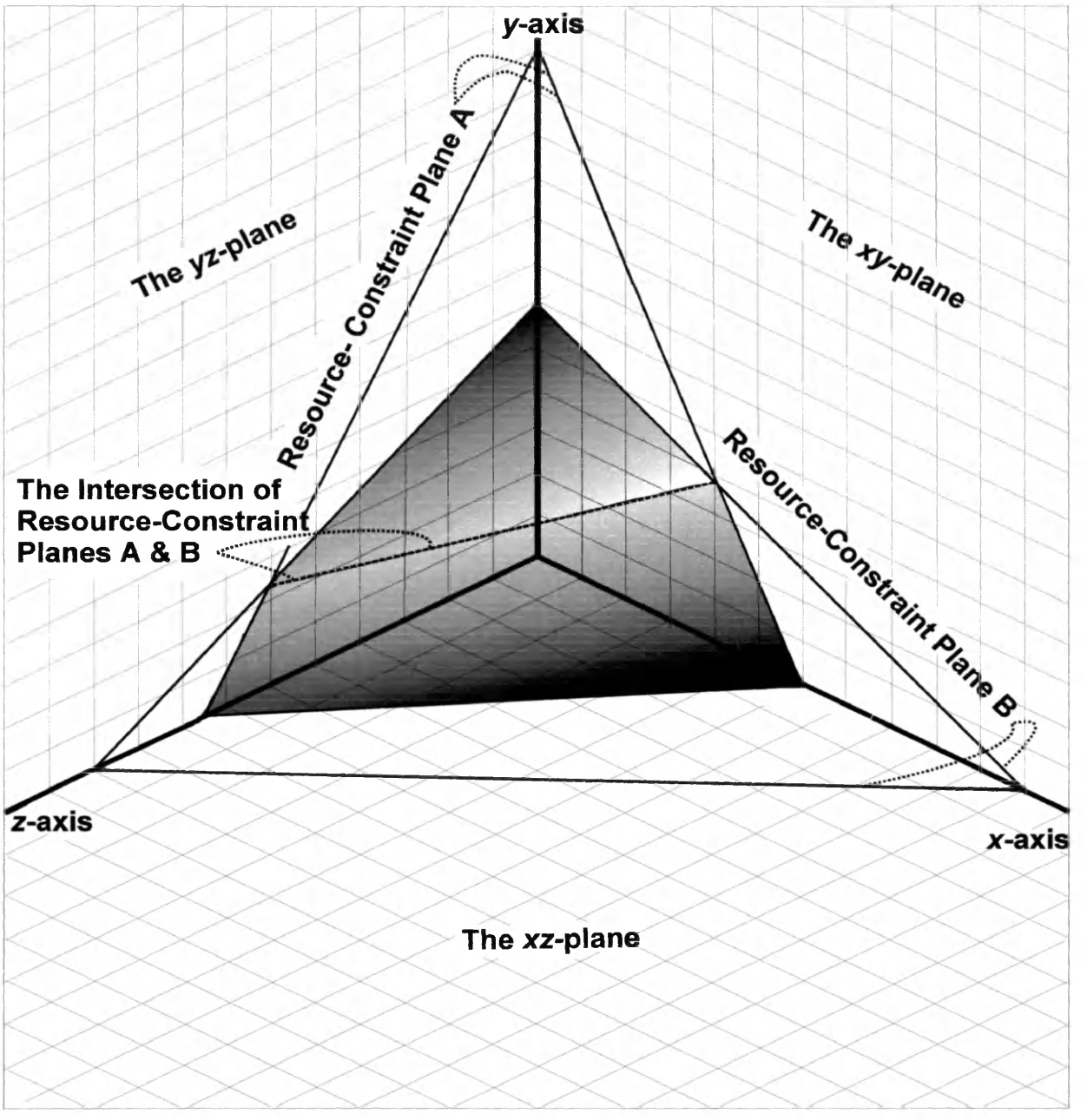

y-axis
The yz-plane
Resource- Constraint Plane A
The xy-plane
The Intersection of
Resource-Constraint
Planes A & B
Resource-Constraint Plane B
z-axis
x-axis
The xz-plane

Figure Caption

Figure 2. Resource-allocation task objectives are defined by the objective function. The objective function operates as a resource-allocation guide for communicating task goals (i.e., maximize the number of projects that can be implemented in one year). Objective and subjective functions are determined by the resource-allocation schemes that help resource allocators achieve optimal solutions. The objective and subjective function planes seen here are illustrated falling outside the 3-D feasible regions but should not be conceptualized as such. Panel A shows the objective function plane representing a resource-allocation scheme leading to the optimal LP solution (0, 9.6, 24). Panel B shows the subjective function plane representing a resource-allocation scheme leading to the optimal solution (16, 16, 0) for the Equity Scenario. Panel C shows the subjective function plane representing a resource-allocation scheme leading to the optimal solution (10, 10, 10) for the Equality Scenario. Panel D shows the subjective function plane representing a resource-allocation scheme leading to the optimal solution (24,0,0) for the Need Scenario.

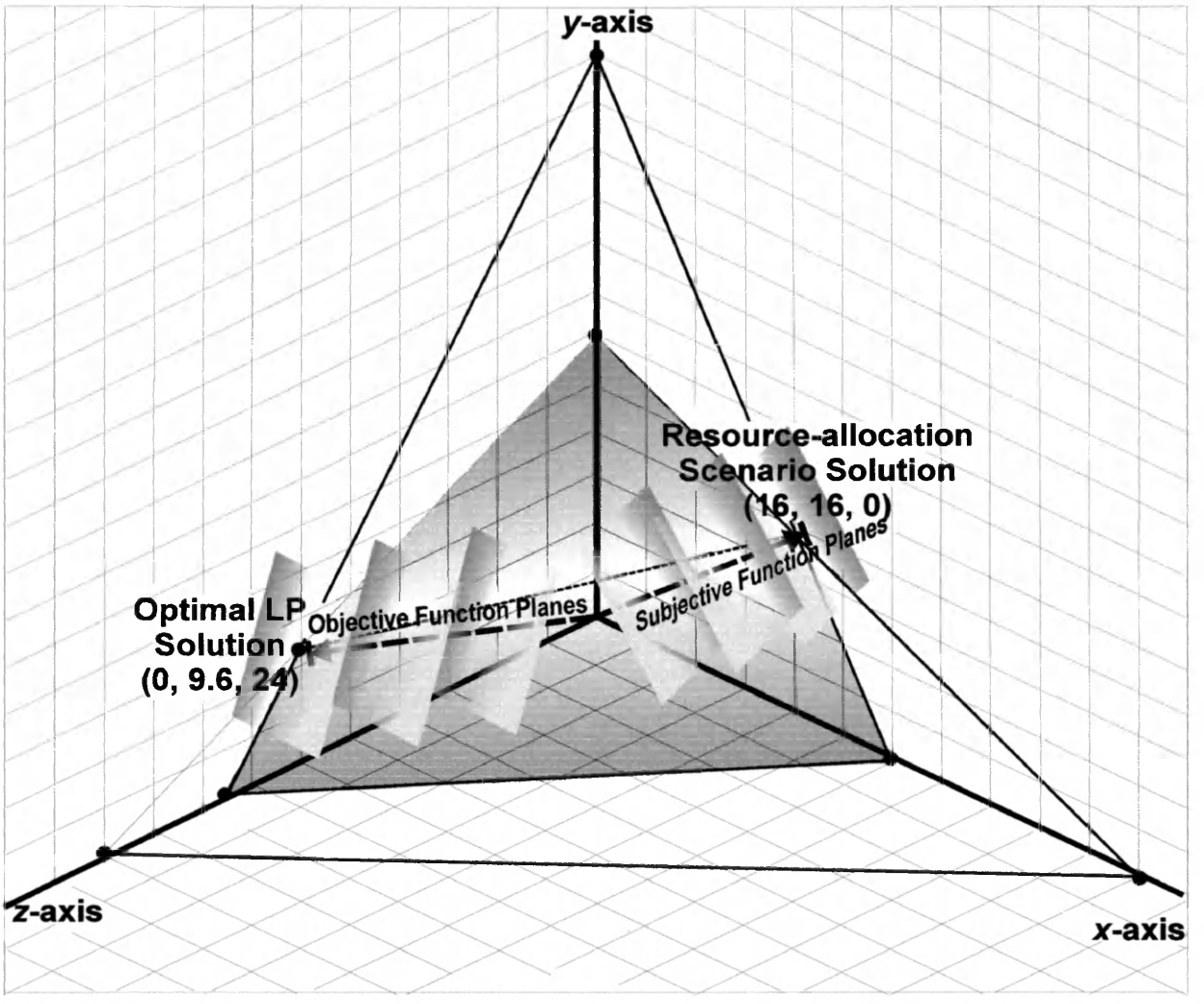

y-axis
Resource-allocation
Scenario Solution
(16, 16, 0)
Optimal LP
Solution
(0, 9.6, 24)
Objective Function Planes
Subjective Function Planes
z-axis
x-axis

Figure Caption

Figure 3. Resource-constraint planes are plotted in the three-dimensional space. The objective of the task was to maximize the number of projects possible to implement in one year when provided with a budget of $192,000 and 720 TEA Corps volunteers. Resource amounts and expenses of each TEA Corps project can be expressed in equation form, which can be represented graphically. The *x*-, *y*-plane represents the possible combinations of Agraria and Tech Republic projects within the feasible region. All possible combinations of Tech Republic and Educaland projects are represented by the *y*-, *z*-plane, and the *x*-, *z*- plane can be used to determine the number of combinations possible for Agraria and Educaland projects.

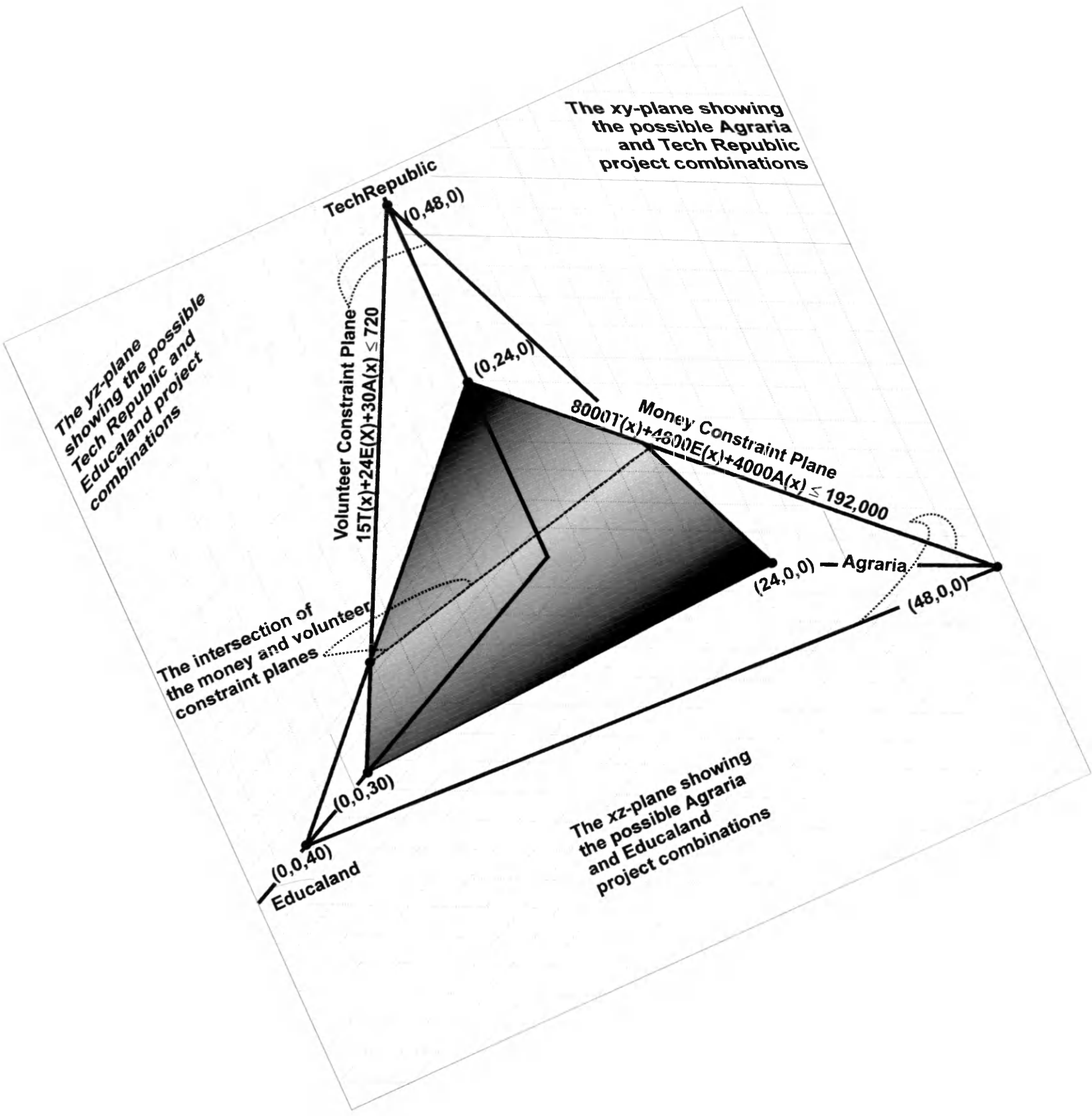

The xy-plane showing the possible Agraria and Tech Republic project combinations
TechRepublic
(0,48,0)
(0,24,0)
Volunteer Constraint Plane
15T(x)+24E(X)+30A(x) ≤ 720
8000T(x)+4800E(x)+4000A(x) ≤ 192,000
Money Constraint Plane
(24,0,0) — Agraria
(48,0,0)
The yz-plane showing the possible Tech Republic and Educaland project combinations
The intersection of the money and volunteer constraint planes
(0,0,30)
(0,0,40)
Educaland
The xz-plane showing the possible Agraria and Educaland project combinations

Figure Caption

Figure 4. Linear and Integer Programming techniques to solve resource-allocation problems can be used to determine normative solutions. In most Linear Programming problems, there is only one optimum solution, whereas multiple optimal solutions may be possible in Integer programming. The LP optimal solution is (0, 9.6, 24). Seven optimal IP solutions in the resource-allocation problem are (0, 8, 25); (0, 9, 24); (0, 10, 23); (1, 9, 23); (1, 10, 22); (1, 11, 21); and (2, 9, 22). All IP solutions represent possible combinations of projects implemented to the Tech Republic, Educaland, and Agraria to achieve the maximum number of projects possible (i.e., 33) given the resource-constraints.

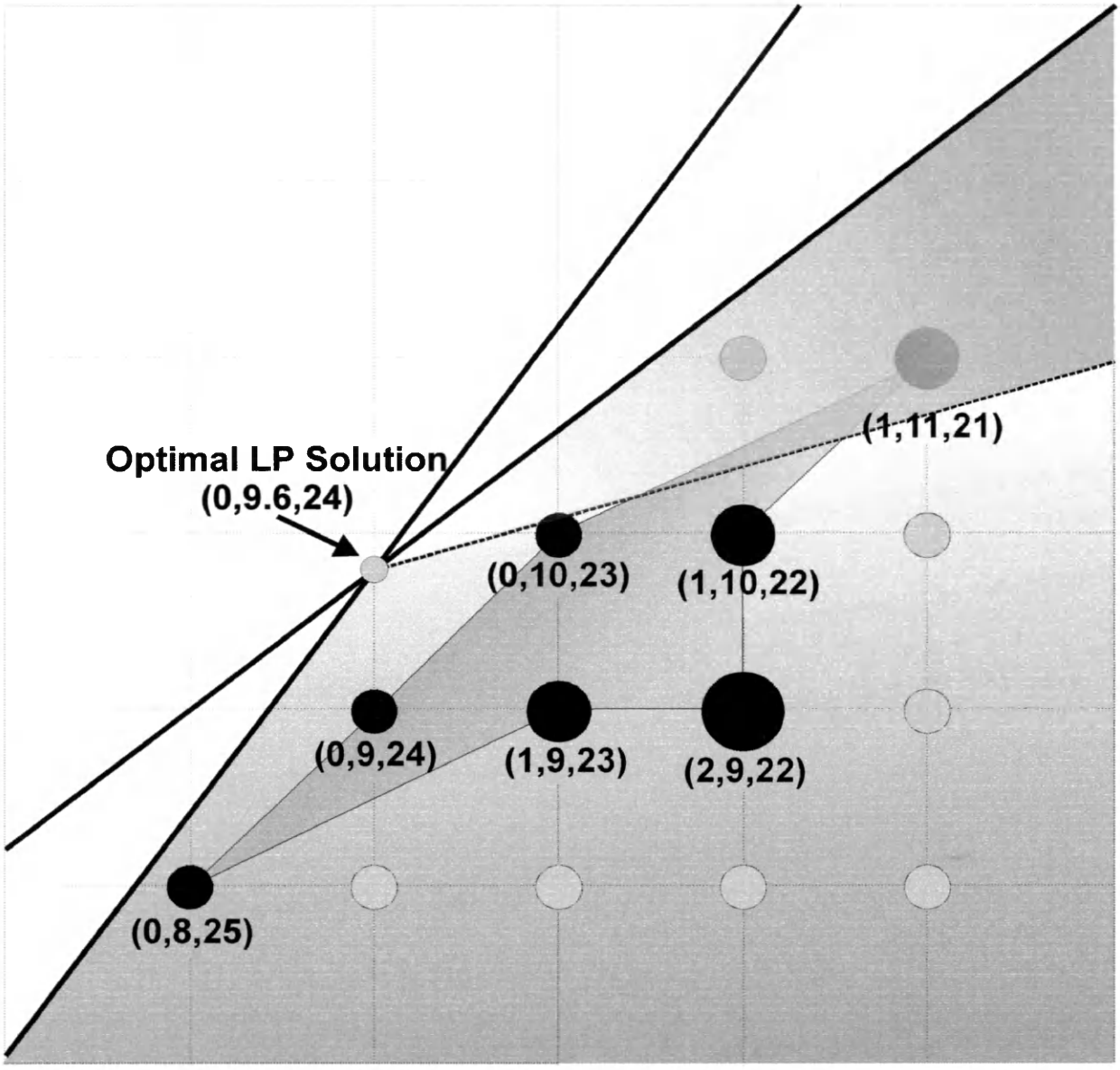
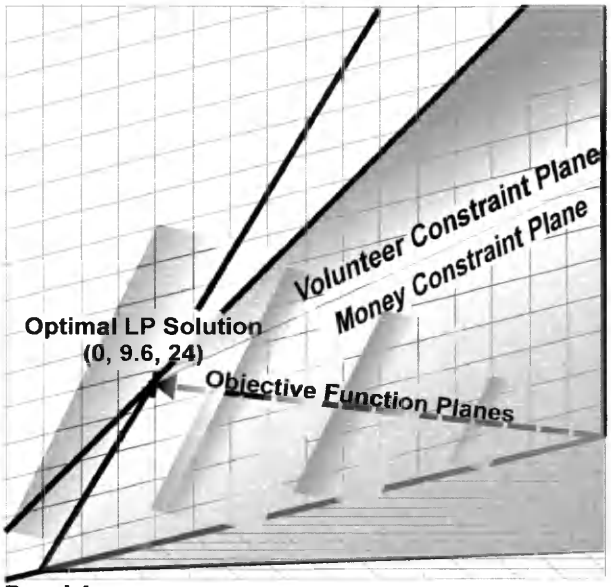
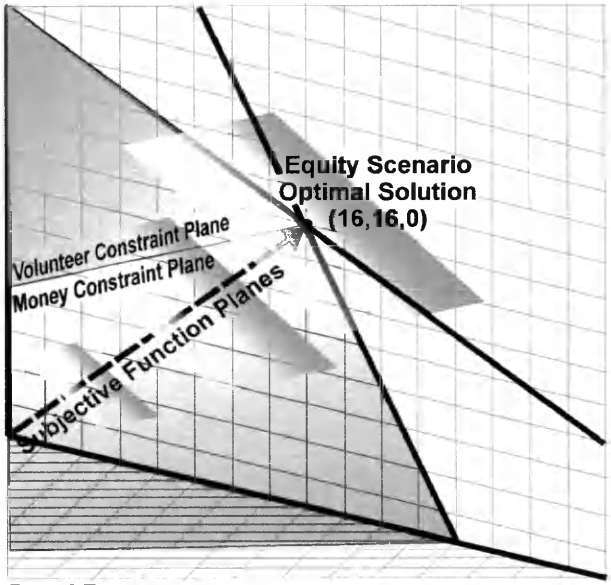

Optimal LP Solution
(0,9.6,24)
(1,11,21)
(0,10,23)
(1,10,22)
(0,9,24)
(1,9,23)
(2,9,22)
(0,8,25)

Figure Caption

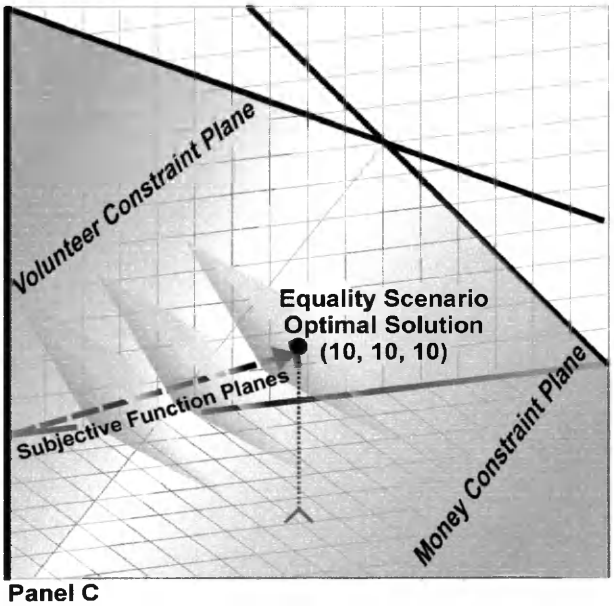
Figure 5. Objective and subjective function planes are represented in a three-dimensional space. These planes represent the orientation that the resource allocator takes. The objective and subjective function planes seen here are illustrated falling outside the 3-D feasible regions but should not be conceptualized as such. Panel A illustrates the objective function plane. With the goal to maximize the number of TEA Corps projects, resource allocators utilize the objective function that represents an allocation scheme leading to the Optimal LP or IP solutions as illustrated in Figure 4. Panel B illustrates the Equality Scenario subjective function. With the goal to equalize the number of projects implemented in the Tech Republic, Educaland, and Agraria, resource allocators utilize the Equality Scenario subjective function that represents an allocation scheme leading to their optimal solution of (10, 10, 10). Panel C illustrates the Equity subjective function. With the goal to maximize resources, resource allocators utilize the Equity Scenario subjective function that represents an allocation scheme leading their optimal solution of (16, 16, 0). Panel D illustrates the Need Scenario subjective function. With the goal to maximize the number of projects implemented in Agraria, resource allocators utilize the Need Scenario subjective function that leads to their optimal solution of (24, 0, 0).



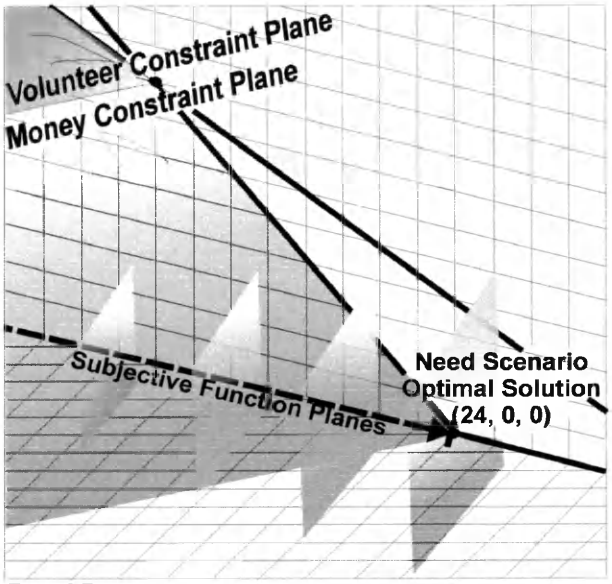
Panel A



Panel B



Panel C



Panel D

Figure Caption

Figure 6. When a group of resource allocators take different perspectives, each resource allocator possesses his or her own subjective orientations. The Subjective Function Planes lead to extreme points in the feasible region. The trajectory of the Subjective Function Plane for Tech Republic delegates leads to their optimal solution of (0, 24, 0). Educaland delegates have a Subjective Function Plane that has the trajectory leading to the optimal solution of (0, 0, 30). The Subjective Function Plane for Agraria delegates has a trajectory that leads to the optimal solution of (24, 0, 0).

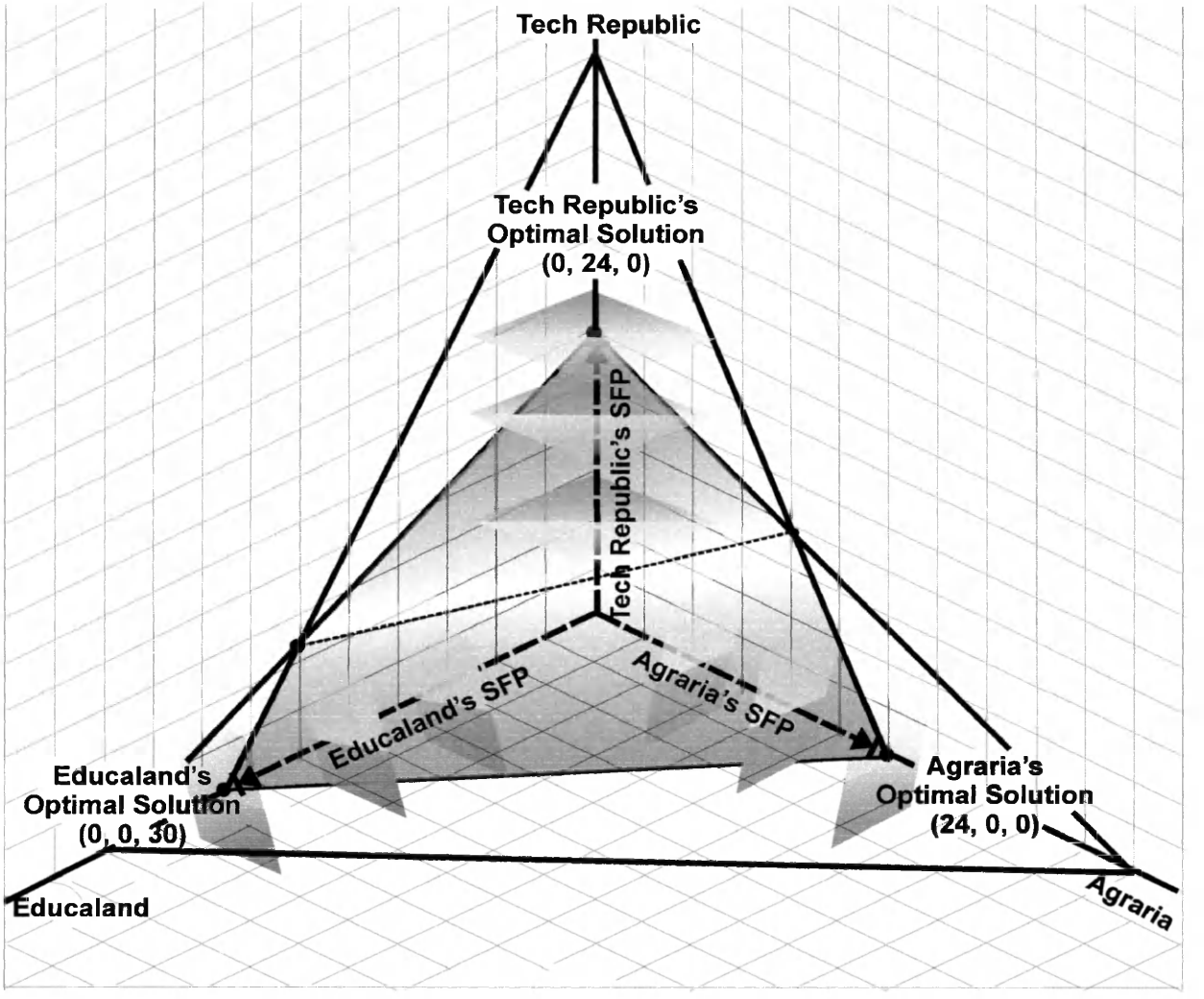

Tech Republic
Tech Republic's
Optimal Solution
(0, 24, 0)
Tech Republic's SFP
Educaland's SFP
Agraria's SFP
Educaland's
Optimal Solution
(0, 0, 30)
Agraria's
Optimal Solution
(24, 0, 0)
Educaland
Agraria

Figure Caption

Figure 7. Contexts in which the resource-allocation problem is presented had an effect on performance. General aspects of the distributive justice principles of equity, equality, and need were the topic in the scenarios. Observed totals of the number of projects implemented were compared to 33, the maximum number of projects possible in one year. Participants in each resource-allocation scenario obtained a percentage of z*, which was the measurement used to evaluate performance. Participants who received the Equity scenario obtained an approximate mean of 93% of z*, while participants who received the Equality and Need scenarios achieved slightly over 92% and 91% of z*, respectively.

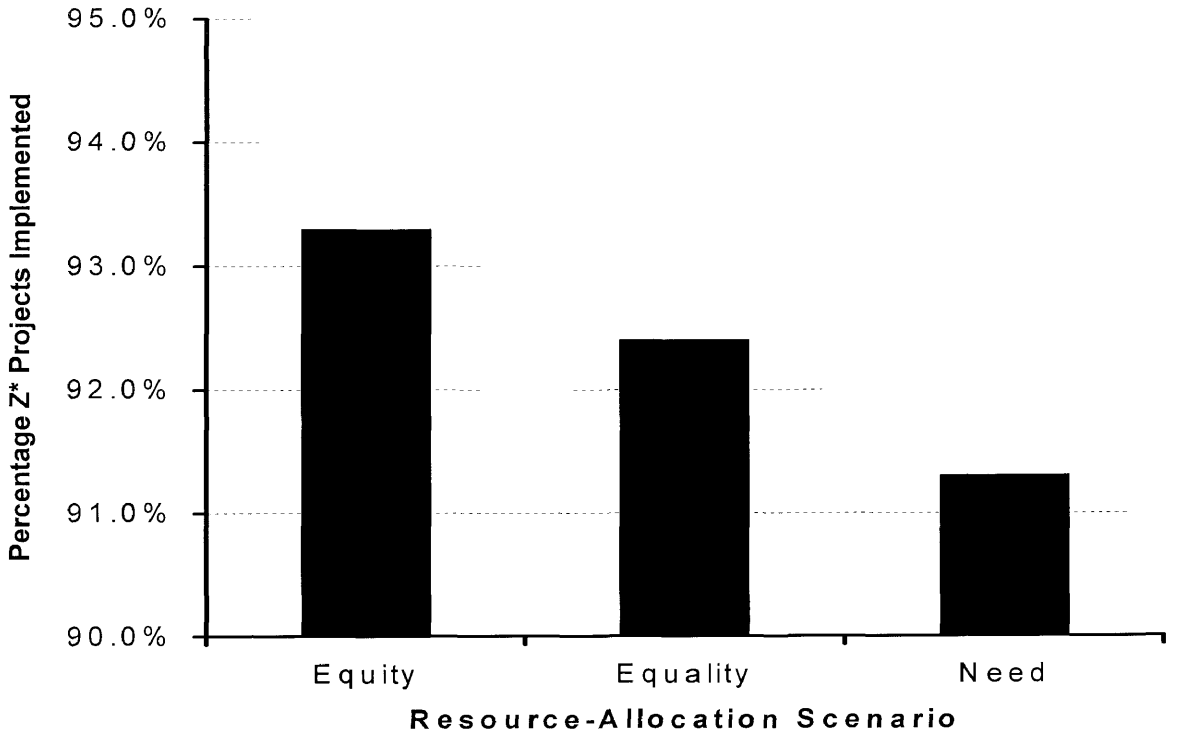

95.0%
94.0%
93.0%
92.0%
91.0%
90.0%
Percentage Z* Projects Implemented
Equity
Equality
Need
Resource-Allocation Scenario

Figure Caption

Figure 8. Themes of distributive justice principles were presented in the Equity, Equality, and Need resource-allocation scenarios. The contexts embedded in the resource-allocation problem had a significant effect on the maximization of money, but not on volunteers. Participants were provided with $192,000 at the beginning of each year and made allocations every month. At the end of the year, participants in the Equity scenario utilized close to 91% of all their money. In the Equality scenario, participants consumed approximately 89% of their money, and 86% of the initial money amount was consumed by participants who received the Need scenario.

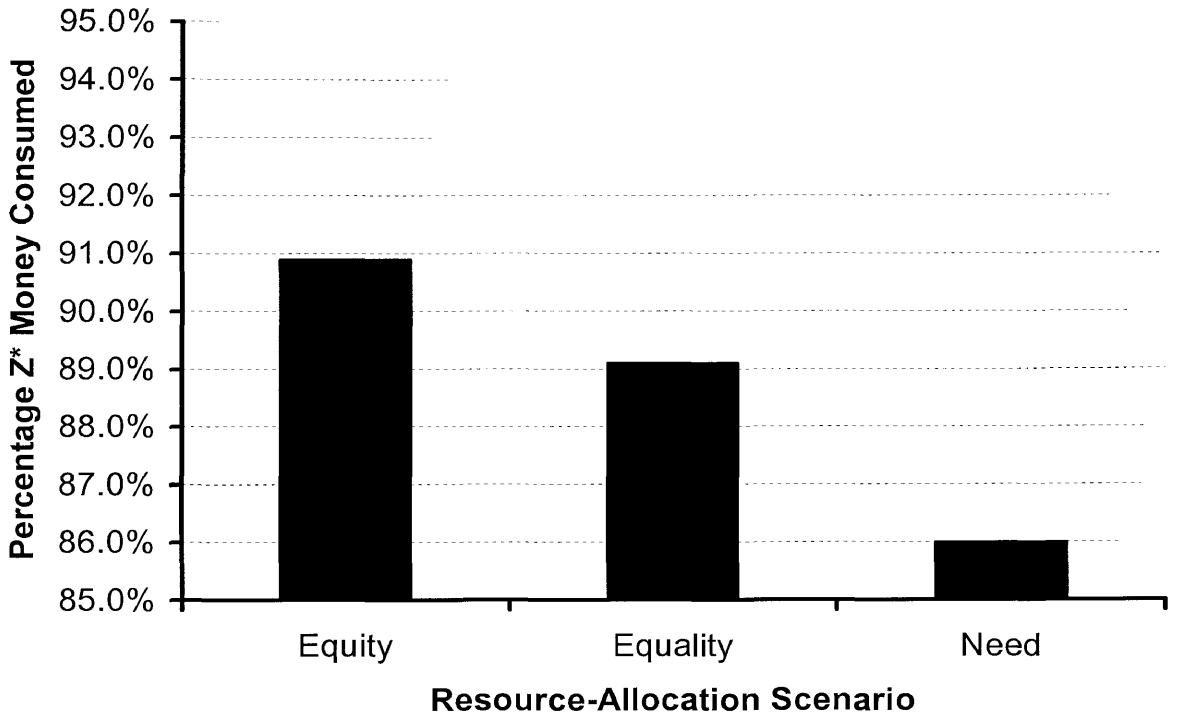

95.0%
94.0%
93.0%
92.0%
91.0%
90.0%
89.0%
88.0%
87.0%
86.0%
85.0%
Percentage Z* Money Consumed
Equity
Equality
Need
Resource-Allocation Scenario

Figure Caption

Figure 9. With a budget of $192,000, participants not only differed in their consumption of money in each resource-allocation scenario, but also differed in their allocations across four trials (i.e., years). Overall, participants learned to utilize more money each year. Participants in the Equity scenario progressed from maximizing approximately 90% of their resources in the first year to 92% by the fourth year. The range was smaller for participants in the Equality scenario, where they consumed 91% of their resources in the first year and 92% on the fourth year. Participants in the Need scenario did not consume as much money as participants in the two other scenarios, but this context facilitated more learning. They utilized approximately 84% of their resources in the first year, and utilized slightly over 87% of the money in the fourth year.

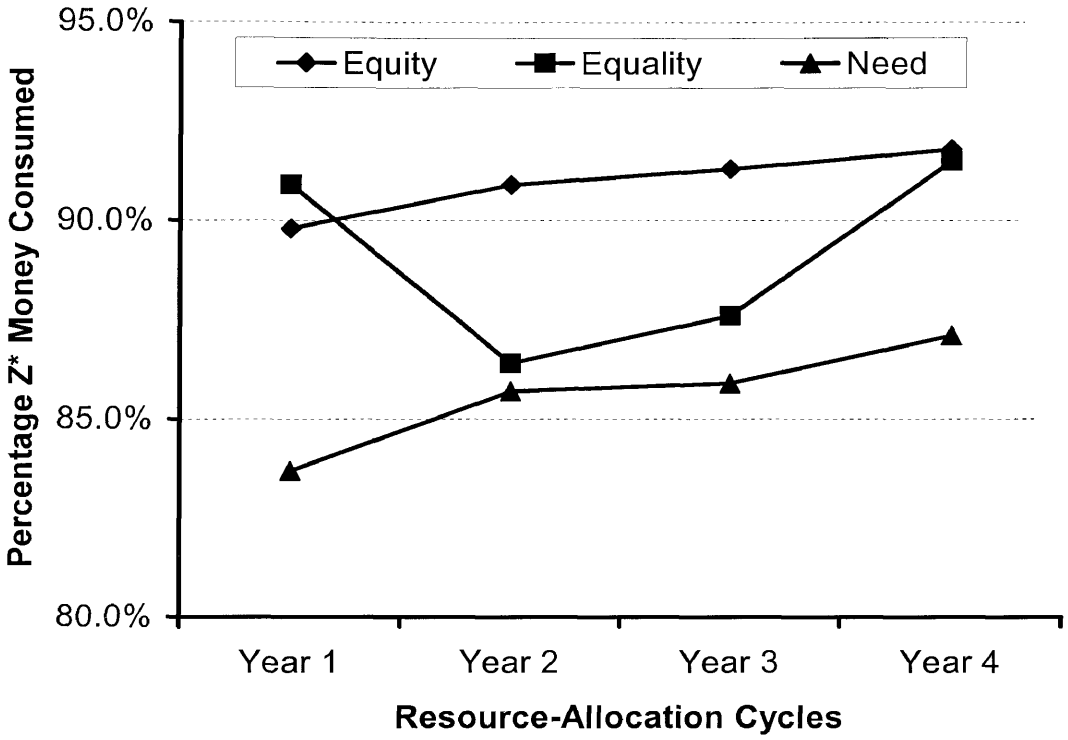

95.0%
90.0%
85.0%
80.0%
Percentage Z* Money Consumed
Equity
Equality
Need
Year 1
Year 2
Year 3
Year 4
Resource-Allocation Cycles

Figure Caption

Figure 10. Over the course of a year, participants implemented TEA Corps projects more aggressively at the beginning of the year and left fewer projects to be implemented at the end of the year. With a provision that a minimum of one project and a maximum of five projects that can be implemented each month, participants demonstrated squandering behavior across all four years that the task was presented. This figure illustrates these dissimilarities in squandering. Individuals implemented an average of 3.8 projects on the first month and an average of 1.5 projects on the last month. Implementation rate for groups was more gradual included an average of 3.2 projects on the first month and an average of 1.9 projects on the last month.

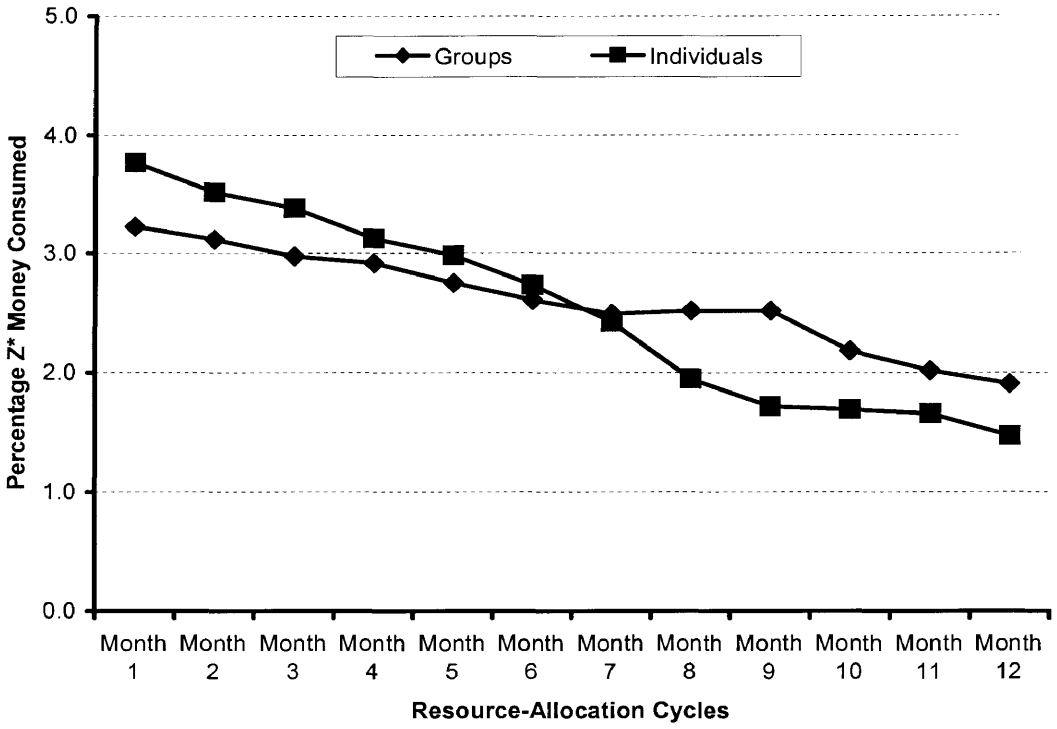

5.0
4.0
3.0
2.0
1.0
0.0
Groups
Individuals
Percentage Z* Money Consumed
Month 1
Month 2
Month 3
Month 4
Month 5
Month 6
Month 7
Month 8
Month 9
Month 10
Month 11
Month 12
Resource-Allocation Cycles

Figure Caption

Figure 11. Money and volunteers were resources used to implement projects every month. Participants were provided with $192,000 and 720 volunteers at the beginning of each year and made allocations each month. They could have utilized resources at an even rate, but participants squandered both their resources throughout the year. Based on the percentage of resources consumed, participants utilize more volunteers as compared to money. On the first month, participants utilized approximately 12% of their allotted volunteers, compared to 10% of the money allotted. By the twelfth month, the rate at which participants consumed resources converged. Participants consumed 5% of both volunteers and money on the last month.

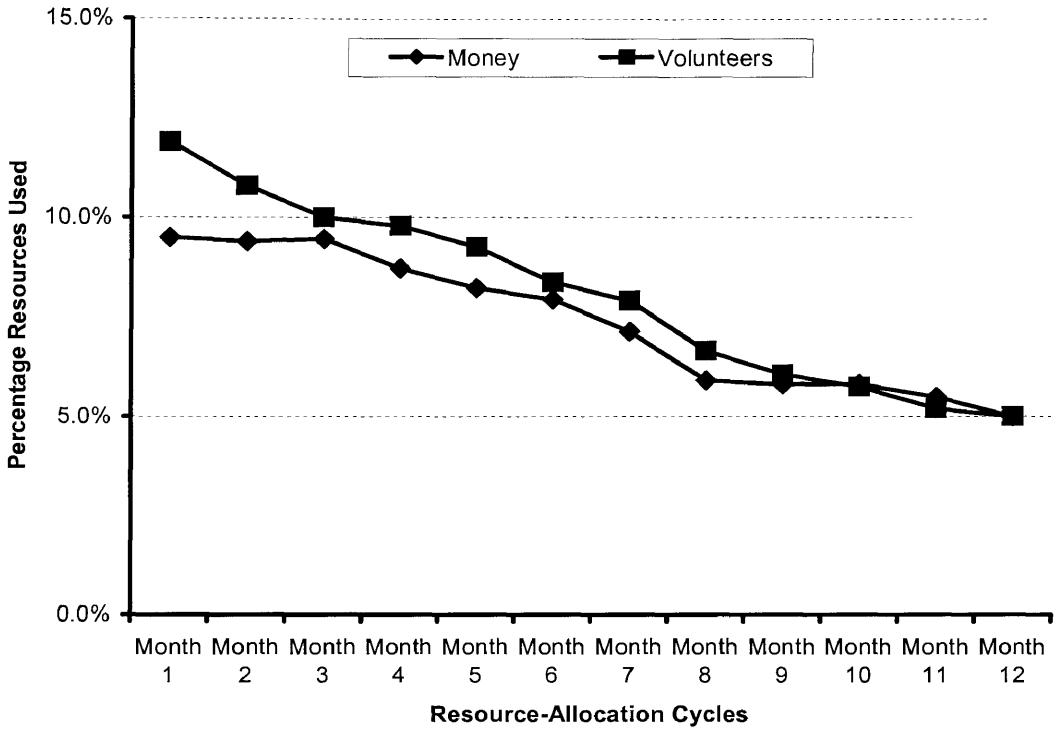
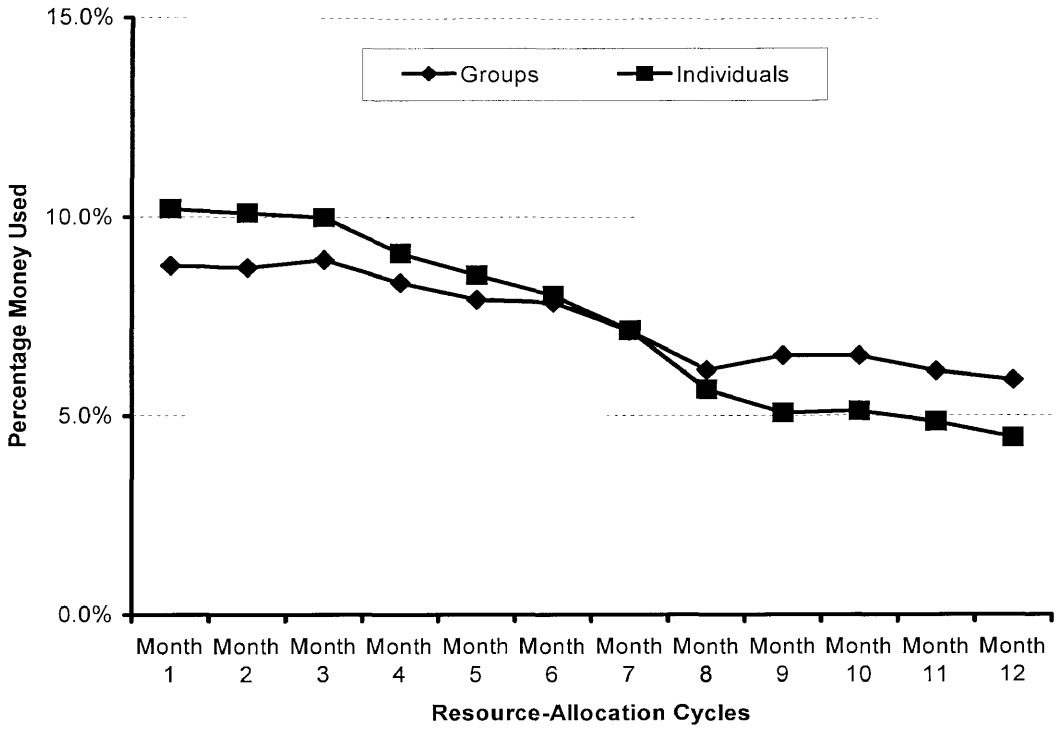
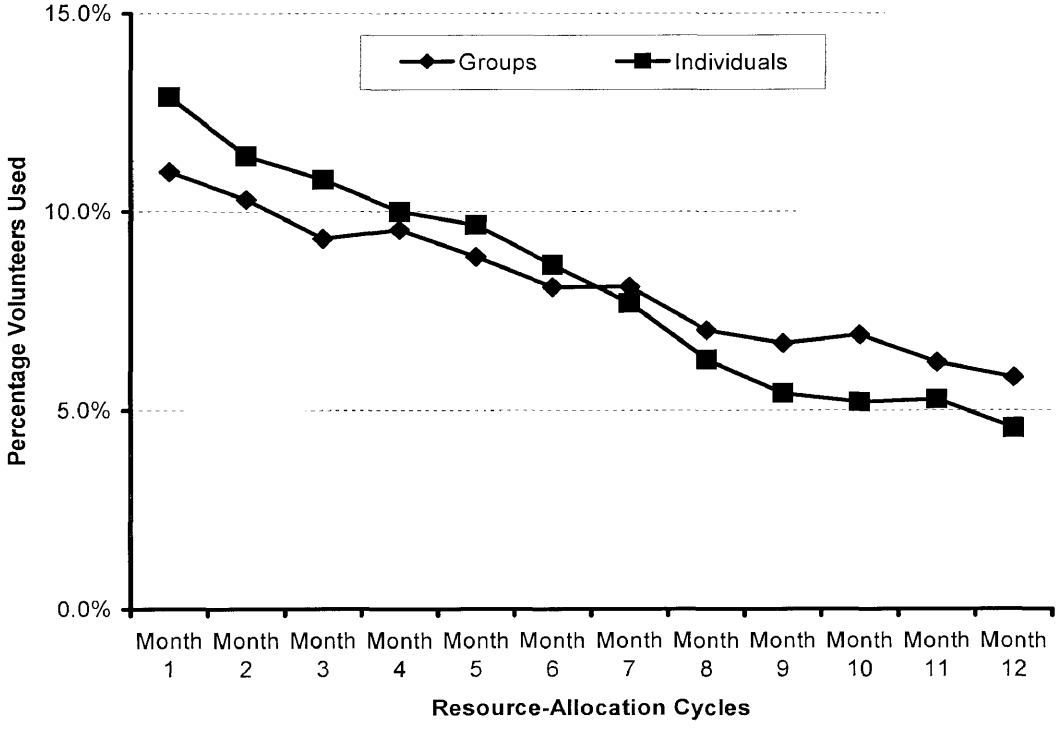

15.0%
10.0%
5.0%
0.0%
Money
Volunteers
Percentage Resources Used
Month 1
Month 2
Month 3
Month 4
Month 5
Month 6
Month 7
Month 8
Month 9
Month 10
Month 11
Month 12
Resource-Allocation Cycles

Figure Caption

Figure 12. Squandering behavior (i.e., consuming resources early and leaving fewer resources to be consumed by the year's end) was observed across all four years. Individuals and three-person groups demonstrated differing squandering behavior. Individuals sharply consumed resources at the beginning in the year and left fewer resources towards the end of the year. In contrast, groups squandered their resources at a gradual rate. Panel A illustrates money consumption rates for individuals and groups over the course of a year. Individuals consumed about 10% of their money in the first month and consumed slightly more than 4% in the last month. Groups consumed money at a rate of almost 9% at the first of the year and consumed at a rate of 6% at the end. Panel B illustrates the rate in which individuals and groups utilized volunteers over a year. Individuals utilized 13% of the number of volunteers available at the beginning of the year and almost 5% at the end of the year. Groups permitted 11% of volunteers to be utilized in the first month and approximately 6% in the last month.



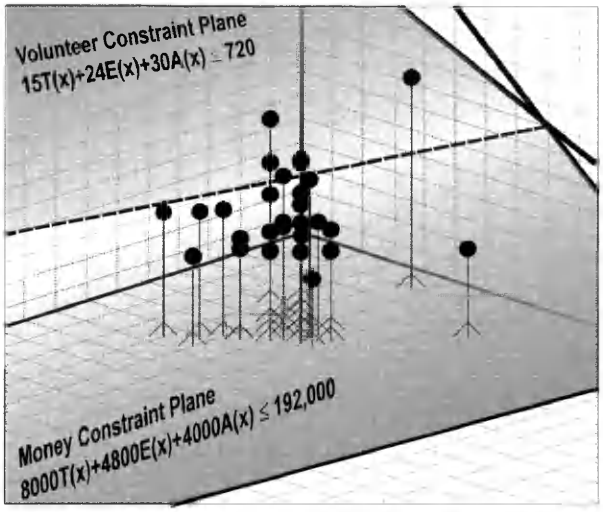
Panel A



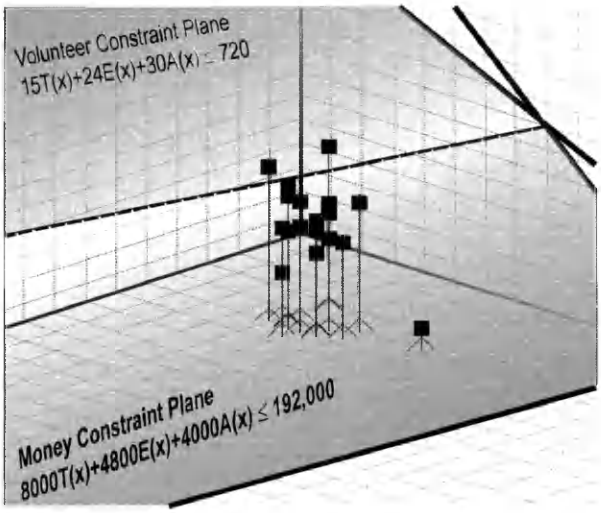
Panel B

Figure Caption

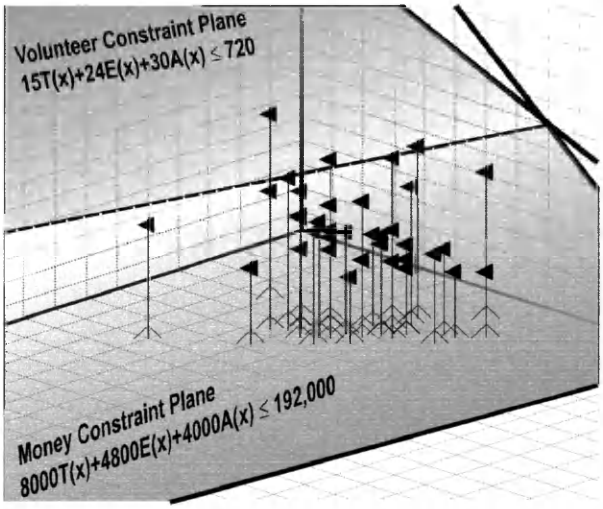
Figure 13. Panel A is an illustration of the endpoint solutions at the conclusion of each year for participants who received the Equity scenario. Overall, the ranges of endpoints (i.e., the combination of projects implemented to Agraria, the Tech Republic, and Educaland in one year) extended from 6-16 projects on the *x*-axis (representing Agraria), 6-18 projects on the *y*-axis (representing the Tech Republic), and 2-15 projects on the *z*-axis (representing Educaland). Panel B shows the endpoints for participants that received the Equality scenario. The overall ranges of endpoints were narrower than the ranges in the Equity scenario: 7-16 projects implemented in Agraria, 5-15 projects implemented in the Tech Republic, and 7-12 projects implemented in Educaland. Panel C exhibits the large variability of endpoints for participants that received the Need scenario. Projects implemented in the scenarios ranged from 6-16, 6-16, and 3-16 in Agraria, the Tech Republic, and Educaland respectively. Panel D demonstrates the variability of endpoints for participants that received the Different Perspectives scenario. Each individual member of the group that received this scenario was an advocate for Agraria, Tech Republic, or Educaland, and ranges of projects for the three countries were 6-14, 7-14, and 5-13 respectively.



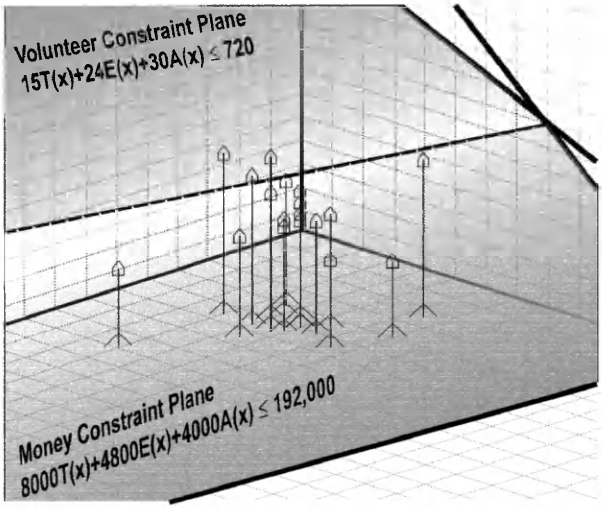
Panel A



Panel B



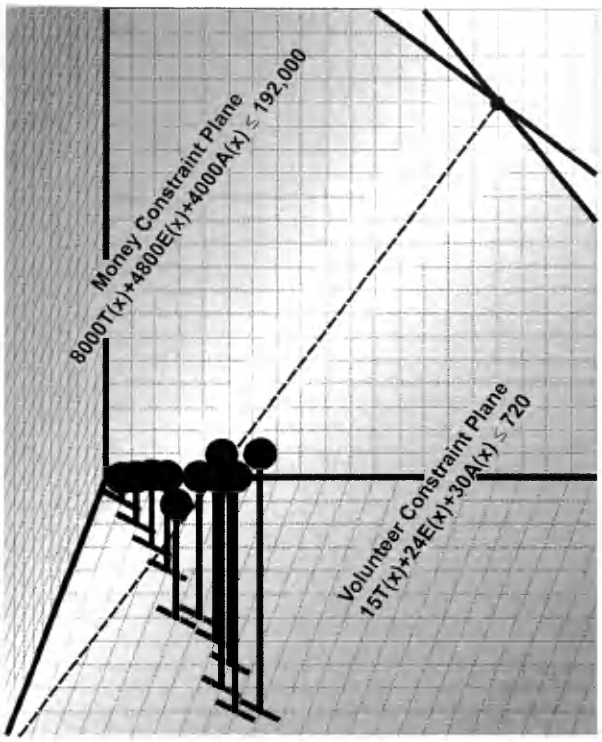
Panel C



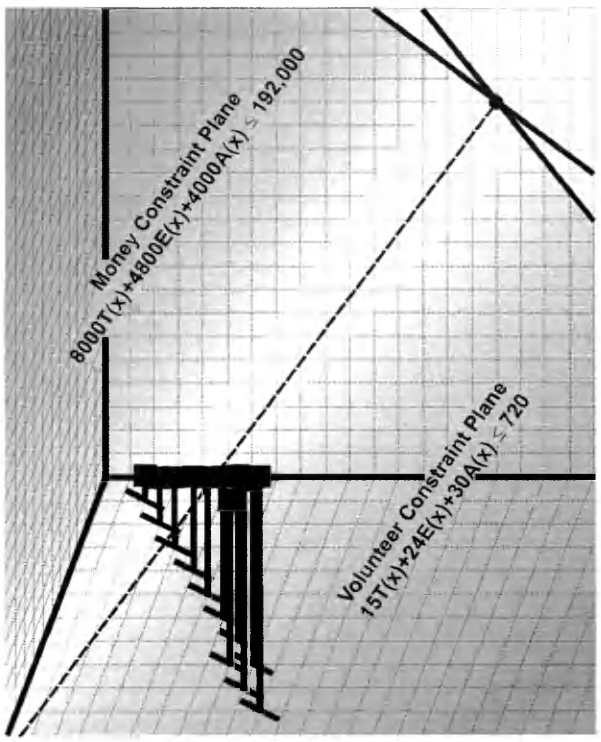
Panel D

Figure Caption

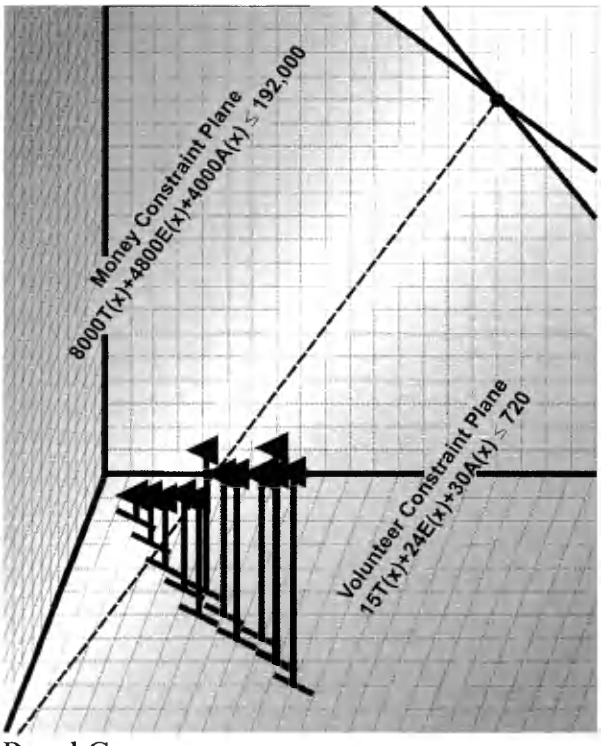
Figure 14. Resource-allocation behavior can differ from situation to situation, even though the same resource-allocation problem is presented. Panel A graphically represents the graphical behavior when the Equity scenario was given. On the first month, resource allocators chose to implement a (1, 1, 1) combination of projects, where *x, y, z* represent Agraria, Tech Republic, and Educaland, respectively. By the twelfth month, resource allocators implemented (10, 11, 11) combination. Panel B represents the graphical behavior when the Equality scenario was given. On the first month, resource allocators implemented a (2, 1, 1) combination of projects and equalized project implementations by the twelfth month to obtain a (10, 10, 10) solution. Panel C represents the graphical behavior of resource allocators when the Need scenario was presented. Resource allocators began their distribution on the first month with a (2, 1, 1) combination and maintained unbalanced distribution throughout the year to obtain a (12, 9, 9) combination of projects implemented on the twelfth month. Panel D represents the graphical behavior of a group of resource allocators given different perspectives. The group approached the task aggressively and began the year with a (2, 2, 1) combination but mitigated behavior by obtaining a (10, 11, 10) combination by the end of the year.



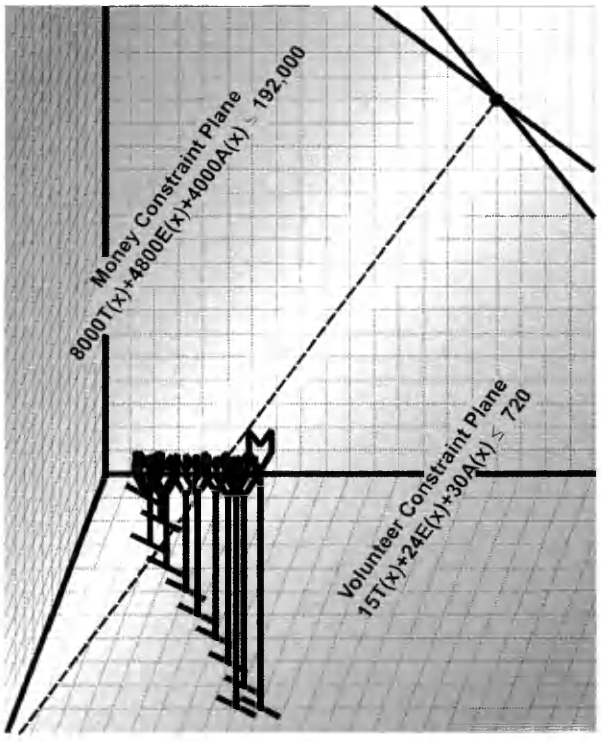
Panel A



Panel B



Panel C



Panel D

APPENDIX

All Participants Received the Following:

The TEA Corps is a non-profit organization that supports underdeveloped countries in the areas of technology, education, and agriculture. As the TEA Corps Director(s) of Project Management, you are in charge of allocating the organization's resources. Your decisions are critical because they influence not only you and your organization, but also the livelihood of underdeveloped countries in the world. The TEA Corps provides two resources-volunteers and money-for aiding countries in need. Members of the TEA Corps go to these countries and volunteer their manpower according to the need of a country. There are 720 volunteers who are trained in technology, education, and agriculture and are equipped to put these projects into action. Money is another resource needed for these operations. The TEA Corps receives donations, all of which go to these projects. They have a yearly budget of $192,000. At the beginning of each month, the TEA Corps implements new projects and completes these projects by the end of each month. The TEA Corps provides aid for three underdeveloped countries: Tech Republic, Educaland, and Agraria.

Each Participant Read One of the Following Scenarios:

Equity Scenario

Each country has its own needs; therefore, resource-allocation requirements for each project differ from country to country. No country is looked upon more favorably than another; your decision is based strictly on the resources that your organization has and the required resources for each project. The resources required to implement one project in each country are described below:

- Every technological project will help the Tech Republic with computers, healthcare, and industrial equipment. Each projects requires 15 volunteers and $8000 to implement.
- Every educational project will help Educaland with the building of schoolhouses, teaching materials, and books. Each project requires 24 volunteers and $4800 to implement.
- Every agricultural project will help Agraria with planting crops, irrigation, and equipment. Each project requires 30 volunteers and $4000 to implement.

Your responsibility is to be objective in your decision-making and to maximize all the resources that the TEA Corps provides to implement these projects (720 volunteers and the budget of $192,000 per year). As you allocate these resources, you must adhere to restrictions of implementing a minimum of 1 project and a maximum of 5 projects per month, for 12 months. At the end of each year, the computer program will reset your resources to the initial amounts. Proceed with each new year until the computer program ends. According to the information provided in this scenario, take the perspective of the TEA Corps Director(s) of Project Management and maximize the number of volunteers and money provided.

Equality Scenario

Each country has its own needs; therefore, resource-allocation requirements for each project differ from country to country. The resources required to implement one project in each country are described below:

- Every technological project will help the Tech Republic with computers, healthcare, and industrial equipment. Each projects requires 15 volunteers and $8000 to implement.
- Every educational project will help Educaland with the building of schoolhouses, teaching materials, and books. Each project requires 24 volunteers and $4800 to implement.
- Every agricultural project will help Agraria with planting crops, irrigation, and equipment. Each project requires 30 volunteers and $4000 to implement.

You would like to see all three countries benefit from what the TEA Corps has to offer. No country is looked upon more favorably than another because each country has its own legitimate needs:

- Tech Republic requests help technology. This country believes that they are ready to increase technology. This country does not have the basic know-how to begin technological advancements. The Tech Republic wants to thrive technologically.
- Educaland requests help in education. The literacy rate is quite low. The country falls below minimum standards for proper education. Educalanders cannot afford to go to school.
- Agraria requests help in agriculture. This country has suffered a drought for many years. This country is very poor. People are starving in Agraria.

You would like to meet the requests of all three countries as much as possible, with the given resources that you have. You must remain neutral in your decision-making as you assign projects to these countries. As you allocate these resources, you must adhere to restrictions of implementing a minimum of 1 project and a maximum of 5 projects per month, for 12 months. At the end of each year, the computer program will reset your resources to the initial amounts. Proceed with each new year until the computer program ends. According to the information provided in this scenario, take the perspective of an impartial TEA Corps Director(s) of Project Management and delegate project responsibilities to your volunteers within the financial budget you have.

Need Scenario

Each country has its own needs; therefore, resource-allocation requirements for each project differ from country to country. The resources required to implement one project in each country are described below:

- Every technological project will help the Tech Republic with computers, healthcare, and industrial equipment. Each project requires 15 volunteers and $8000 to implement.
- Every educational project will help Educaland with the building of schoolhouses, teaching materials, and books. Each project requires 24 volunteers and $4800 to implement.
- Every agricultural project will help Agraria with planting crops, irrigation, and equipment. Each project requires 30 volunteers and $4000 to implement.

Each country has its own legitimate needs:

- Tech Republic requests help technology
- Educaland requests help in education

- Agraria requests help in agriculture

Agraria is a country that has suffered a drought for decades. This country is very poor, and many people starve with hunger in Agraria. Although the Tech Republic and Educaland have their own needs, you are aware that Agraria is in greater desperation for your help. As the Director of Project Management, you have the power to provide Agraria with tremendous relief, and you would like to see Agraria benefit from what the TEA Corps has to offer. As you allocate these resources, you must adhere to restrictions of implementing a minimum of 1 project and a maximum of 5 projects per month, for 12 months. At the end of each year, the computer program will reset your resources to the initial amounts. Proceed with each new year until the computer program ends. According to the information provided in this scenario, take the perspective of a sympathetic TEA Corps Director(s) of Project Management and delegate project responsibilities to your volunteers within the financial budget you have.

REFERENCES

Adams, J. S. (1965). Inequity in social exchange. In L. Berkowitz (Ed.), *Advances in experimental social psychology*. New York: Academic Press.

Allison, S. T., McQueen, L. R., & Schaerfl, L. M. (1992). Social decision making processes and the equal partitionment of shared resources. *Journal of Experimental Social Psychology, 28*(1), 23-42.

Allison, S. T., & Messick, D. M. (1990). Social decision heuristics in the use of shared resources. *Journal of Behavioral Decsion Making, 3*(3), 195-204.

Ball, C. T., Langholtz, H., Auble, J., & Sopchak, B. (1998). Resource-allocation strategies: A verbal protocol analysis. *Organizational Behavior and Human Decision Processes, 76*(1), 70-88.

Bazerman, M. H., White, S. B., & Loewenstein, G. F. (1995). Perception of fairness in interpersonal and individual choice situations. *Current Directions in Psychological Science*, 39-43.

Berkowitz, L., & Walster, E. (Eds.). (1976). *Equity theory: Toward a general theory of social interaction* (Vol. 9). New York: Academic Press, Inc.

Boldero, J., & Rosenthal, D. (1984). Equity, compromise, and competition: Effects of situational variables and type of allocation pool. *Journal of Social Psychology, 123*(2), 207-221.

Busemeyer, J., & Myung, I. (1987). Resource allocation decision making in an uncertain environment. *Acta Psychologica*(66), 1-19.

Busemeyer, J., Swenson, K., & Lazarte, A. (1986). An adaptive approach to resource allocation. *Organizational Behavior and Human Decision Processes*(38), 318-341.

Clayton, S. (2000). Models of justice in the environmental debate. *Journal of Social Issues, 56*(3), 459.

Cohen, J. (1982). Cooperative and competitive styles: The construct and its relevance. *Human Relations, 35*(8), 621-633.

Cropanzano, R. (Ed.). (2001). *Justice in the workplace* (Vol. 2). Mahwah: Lawrence Erlbaum Associates.

Dantzig, G. B. (1963). *Linear programming and extensions*. Princeton, NJ: Princeton University Press.

Deutsch, M. (1975). Equity, equality, and need: What determines which value will be used as the basis of distributive justice? *Journal of Social Issues, 31*(3), 137-149.

Deutsch, M. (1976). Experimental studies of the effects of different systems of distributive justice. In J. C. Masters & W. P. Smith (Eds.), *Social comparison, social justic, and relative deprivation* (pp. 151-164). Hillsdale: Lawrence Erlbaum Associates, Inc.

Deutsch, M. (2000a). Cooperation and competition. In M. Deutsch & P. T. Coleman (Eds.), *Handbook of conflict resolution* (pp. 21-40). San Francisco: Jossey-Bass Publishers.

Deutsch, M. (2000b). Justice and Conflict. In M. Deutsch & P. T. Coleman (Eds.), *Handbook of conflict resolution* (pp. 41-64). San Francisco: Jossey-Bass Publishers.

Deutsch, M., & Coleman, P. T. (Eds.). (2000). *The handbook of conflict resolution: Theory and practice*. San Francisco: Jossey-Bass Publishers.

Elliott, G. C., & Meeker, B. F. (1984). Modifiers of the equity effect: group outcome and causes for individual perfomrnace. *Journal of Personality and Social Psychology, 46*(3), 586-597.

Ellis, D., & Fisher, B. A. (Eds.). (1994). *Small group decision making: Communication and the group process* (4 ed.). New York: McGraw-Hill, Inc.

Festinger, L. (1954). A theory of social comparison processes. *Human Relations, 7*, 117-140.

Folger, R., & Kass, E. E. (2000). Social comparison and fairness: A counterfactual simulations perspective. In J. Suls & L. Wheeler (Eds.), *Handbook of social comparison: Theory and research* (pp. 423-441). New York: Kleuwer Academic.

Gilliland, S. W. (1993). The perceived fairness of selection systems: An organizational justice perspective. *Academy of Management Review, 18*(4), 694(641).

Gingrich, G., & Soli, S. (1984). Subjective evaluation and allocation of resources in routine decision making. *Organizational Behavior and Human Decision Processes*(33), 187-203.

Gonzalez, R. (2001). *Individual versus group resource-allocation performance.*, College of William and Mary, Williamsburg.

Greenberg, J. (1983). Self-image versus impression management in adherence to distributive standards. *Journal of Personality and Social Psychology, 44*, 5-19.

Harris, R. J., & Joyce, M. A. (1980). What's fair? It depends on how you phrase the question. *Journal of Personality and Social Psychology, 38*(1), 165-179.

Hinsz, V. B. (1999). Group decision making with resopnses of a quantitative nature: The theory of social decision schemes for quantities. *Organizational Behavior and Human Decision Processes, 80*(1), 28-49.

Homans, G. (1961). *Social behavior; Its elementary forms*. New York: Harcourt Brace.

Hyder, E. B., Prietula, M. J., & Weingart, L. R. (2000). Getting to Best: Efficiency versus Optimality in Negotiation. *Cognitive Science, 24*(12), 169.

Jansson, A. (1999). Goal achievement and mental models in everyday decision making. In P. Juslin & H. Montgomery (Eds.), *Judgment and decision making: Neo-brunswikian and process-tracing approaches* (pp. 23-43). Mahwah: Lawrence Erlbaum and Associates.

Langholtz, H. (1994). Allocating resources over time in benign and harsh environments. *Organizational Behavior and Human Decision Processes, 58*, 28-50.

Langholtz, H. (1995). Are resource fluctuations anticipated resource allocation tasks? *Organizational Behavior and Human Decision Processes, 63*(3), 274-282.

Langholtz, H. (1997). Resource-allocation behavior in complex but commonplace tasks. *Organizational Behavior and Human Decision Processes, 70*(3), 249-266.

Langholtz, H., Gettys, C., & Foote, B. (1993). Resource-allocation behavior under certainty, risk, and uncertainty. *Organizational Behavior and Human Decision Processes, 54*, 203-224.

Lapin, L. (1981). *Quantitative methods for business decisions*. New York: Harcourt Brace.

Lerner, M. J., & Lerner, S. C. (1981). *The justice motive in social behavior*. New York: Plenum.

Lerner, M. J., Miller, D. T., & Holmes, J. G. (1976). Deserving and the emergence of forms of justice. In L. Berkowitz & E. Walster (Eds.), *Equity theory: Toward a general theory in social interaction* (Vol. 9, pp. 133-162). New York: Academic Press, Inc.

Leventhal, G. S. (1976). The distribution of rewards and resources in groups and organizations. In L. Berkowitz & E. Walster (Eds.), *Equity theory: Toward a general theory in social interaction* (Vol. 9, pp. 92-131). New York: Academic Press, Inc.

Leventhal, G. S. (1980). What should be done with equity theory? In K. Gergen & M. Greenberg & R. Willis (Eds.), *Social exchange: Advances in theory and research* (pp. 22-55). New York: Plenum.

Mannix, E. A., Neale, M. A., & Northcraft, G. B. (1995). Equity, equality, or need? The effects of organizational culture on the allocation of benefits and burdens. *Organizational Behavior and Human Decision Processes, 63*(3), 276-286.

Mannix, E. A., & White, S. B. (1992). The impact of distributive uncertainty on coalition formation in organizations. *Organizational Behavior and Human Decision Processes, 51*(2), 198-219.

Marty, A. (2001). *Social contexts embedded in resource-allocation decisions.* Williamsburg: College of William and Mary.

Masters, J. C., & Smith, W. P. (Eds.). (1987). *Social comparison, social justice, and relative deprivation.* Hillsdale: Lawrence Erlbaum and Associates, Inc.

Messick, D. M. (1983). Fairness, preference, and fairness biases. In D. Messick & K. Cook (Eds.), *Equity theory: Psychological contributions from psychological research*. New York: Springer-Verlag.

Messick, D. M., Bloom, S., Boldizar, J. P., & Samuelson, C. D. (1985). Why we are fairer than others. *Journal of Experimental Social Psychology, 21*(5), 480-500.

Miller, D. (1999). *Principles of social justice*. Cambridge: Harvard University press.

Nolan, E. (2000). *Resource-allocation behavior when payoff is not equal.*, College of William and Mary, Williamsburg.

Ohtsubo, Y., & Kameda, T. (1997). The function of equality heuristic in distributive baragining: Negotiated allocation of costs and benefits in a demand revelation context. *Journal of Experimental Social Psychology, 34*, 90-108.

Parks, C. D., & Sanna, L. J. (Eds.). (1999). *Group performance and interaction*. Boulder: Westview Press.

Payne, J. W., Bettman, J. R., & Johnson, E. L. (1993). *The adaptive decision-maker*. Cambridge: Cambridge Unversity Press.

Pepitone, A. (1971). The role of justice in interdependent decision making. *Journal of Experimental Social Psychology, 7*, 1144-1156.

Rasinski, K. A. (1987). What's fair is fair--or is it? Value differences underlying public views about social justice. *Journal of Personality and Social Psychology, 53*, 201-211.

Rawls, J. (1971). *A theory of justice*. Cambridge, MA: Belknap Press.

Reis, H. T. (1987). The nature of the justice motive: Some thoughts on operation, internalization, and justification. In J. C. Masters & W. P. Smith (Eds.), *Social*

comparison, social justice, and relative deprivation (pp. 131-150). Hillsdale: Lawrence Erlbaum Associates, Inc.

Samuelson, C. D., & Allison, S. T. (1994). Cognitive factors affecting the use of social decision heuristics in resource-sharing tasks. *Organizational Behavior and Human Decision Processes, 58*, 1-27.

Skitka, L. J., & Tetlock, P. E. (1992). Allocating scarce resources: A contingency model of distributive justice. *Journal of Experimental Social Psychology, 28*(6), 491(432).

Slade, S. (1994). *Goal-based decision Making: An interpersonal model*. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Sondak, H., Neale, M. A., & Pinkley, R. (1995). The negotiated allocation of benefits and burdens: The impact of outcome valence, contribution, and relationship. *Organizational Behavior and Human Decision Processes, 64*(3), 249-260.

Surazska. (1986). Normative and instrumental functions of equity critereia in individual choices of the input-payoff distribution pattern. *Journal of Conflict Resolution, 30*(3), 532-550.

Tetlock, P. E. (1985). Accountability: The neglected social context of judgment and choice. *Research in Organizational Behavior, 7*, 297-332.

Thibaut, J. W., & Kelley, H. H. (1959). *The social psychology of groups*. New York: Wiley.

Thompson, L., & Hastie, R. (1990). Social perception in negotiation. *Organizational Behavior and Human Decision Processes, 47*, 98-123.

Tjosvold, D. (1988). Effects of shared responsibility and goal interdependence on controversy and decision making between departments. *Journal of Social Psychology, 128*(1), 7-18.

Tversky, A., Sattath, S., & Slovic, P. (1988). Contingent weighting in judgment and choice. *Psychological Review, 95*(3), 371-384.

Tyler, T. R., & Griffin, E. (1991). The influence of decision maker's goals on their concerns about procedural justice. *Journal of Applied Social Psychology, 21*(20), 1629-1658.

Wagstaff, G., Huggins, J. P., & Perfect, T. J. (1993). Equity, equality, and need in the adult family. *Journal of Social Psychology, 133*(4), 439(435).

Walster, E., Berscheid, E., & Walster, G. W. (1976). New directions in equity research. In L. Berkowitz & E. Walster (Eds.), *Equity theory: Toward a general theory of social interaction* (Vol. 9, pp. 1-42). New York: Academic Press, Inc.

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