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EFFECT OF BIASES ON ECONOMIC DECISION MAKING: AN EXPERIMENTAL APPROACH

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A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements of the degree of Master of Science.

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ABSTRACT

Effect Of Biases On Economic Decision Making: An Experimental Approach

by Elizabeth L. Buck

Neoclassical economics assumes that consumers have stable, well-defined preferences. However, only 16% of subjects selected a chocolate bar when given a choice between it and a coffee cup, while 43% kept a chocolate bar previously given to them when offered a trade for a coffee cup. Instructional wording had no effect. These results support the hypothesis that people value losses more than gains.

Subjects were asked their willingness-to-pay (WTP) for twelve goods classified as either public or private, or as environmental or nonenvironmental. WTP tended to be lower for public goods when subjects previously ranked the personal importance or benefit they placed on the good. Importance was a weaker bias than benefit. Benefit appeared to induce free rider behaviour for public goods. The only environmental good affected by reading about sustainable development was one specifically mentioned in the article. Biases affecting WTP did not generally affect attributes correlated to WTP.

RÉSUMÉ

Les effets des biais sur la prise de décisions économiques: une approche expérimentale

par Elizabeth L. Buck

L'économie néoclassique suppose que les consommateurs ont des préférences stables et bien définies. Cependant, cette étude montre que seulement 16% des sujets ont sélectionné une tablette de chocolat lorsqu'ils ont eu le choix entre celle-ci et une tasse à café, mais 43% ont retenu la tablette de chocolat qui leur a été donnée auparavant, quand une opportunité de l'échanger pour la tasse à café leur a été offerte. La formulation des instructions n'a eu aucun effet. Ces résultats supportent l'hypothèse que les gens font valoir les pertes plus que les gains.

Les sujets ont été questionnés sur leur volonté-à-payer (V.À.P.) pour douze biens classifiés comme publiques ou privés, ou comme biens environnementaux ou non-environnementaux. Les sujets ont eu une tendance à diminuer leur V.À.P. pour les biens publiques quand ils ont préalablement estimé l'importance ou l'avantage personnels qu'ils ont placé sur le bien. L'importance était un biais plus faible que l'avantage. Le biais de l'avantage a semblé induire un comportement resquilleur pour les biens publiques. Le seul bien environnemental influencé par la lecture d'un article sur le développement durable était celui qui a été spécifiquement mentionné dans l'article. Les biais qui ont influencé la V.À.P n'ont pas généralement influencé les attributs corrélés à la V.À.P.

PREFACE

I thank the Department of Agricultural Economics at McGill University for funding the experiments conducted for this study. In addition, I am grateful for the generous financial support provided to me by the Lewis B. Fischer Graduate Bursary in Agricultural Economics and the Max Binz Special Fellowship.

To my fellow graduate students, Teklay Messele, Youssouf Camara and George Lusier, I extend my heart-felt thanks for helping with the logistics of the experiments and without whose assistance these experiments could never have been conducted. To my office mates, Teklay, Anita, and Gilles, thank you for listening to my ideas about consumer choice theory and for giving me your insights and encouragement.

Moreover, I thank my thesis supervisor, Paul Thomassin, for his thoughtful input into the design of the experiments, his ability to squeeze out enough money to pay for them, his assistance in arranging to have a classroom downtown, and his invaluable help conducting the pretest and final experiments.

I appreciate the assistance of the McGill University Bookstore and Eaton Department Store in obtaining the items used in the first experiment. My thanks to the McGill Undergraduate Student's Association for allowing me to store my coffee cups and candy bars.

For aid with my numerous statistical questions, I thank the Université Laval statistical consulting service and especially, M. Claude Camiré. A special thanks to Maryellen Thirolf, who taught me a more effective way to write technical documents.

There are not words to express my deep appreciation to Hank Margolis, my wonderful husband, who has always believed in me and encouraged me to finish.

For this thesis, I have chosen a manuscript-based structure because I intend to submit Chapters 2 and 3 to refereed economic journals. Thus, in accordance with the requirements of Faculty of Graduate Studies and Research at McGill University, the following

information on Faculty regulations has been included. It should be noted, however, that this is a Master's thesis and any references to the doctoral dissertation should be disregarded. Moreover, these manuscripts will be co-authored with Dr. Paul Thomassin, my thesis supervisor. Dr. Thomassin assisted with the design, logistics and execution of the experiments described in this document.

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GLOSSARY

Allocative efficiency	No Pareto improving reallocation of resources exists along the production possibilities curve.
Compact set	A nonempty set that is closed and bounded.
Completeness	For all **a** and **b** in the consumption set C, either $\mathbf{a} \succeq \mathbf{b}$ or $\mathbf{b} \succeq \mathbf{a}$, or both.
Concave function	The function evaluated at the weighted average of points i and j is greater than or equal to the weighted average of the function evaluated at points i and j.
Continuity	A function is continuous at every element in its domain.
Efficiency (Pareto efficiency)	The state of an economy when there is allocative efficiency, production efficiency and consumption efficiency so that no one can be made better off without making someone worse off.
Externality	Activity of one entity affects the welfare of another entity outside the market, such that the marginal societal costs are not equal to the marginal private costs.
Framing bias	Outcomes depend on how questions are asked, e.g., responses will be different if the outcome is described as a loss than as a gain.
Hessian matrix	A symmetric matrix of second-order mixed partial derivatives of a function.

Local nonsatiation	Given any **a** in the consumption set C and any $\varepsilon > 0$, then there is some bundle **b** in C with $\|a - b\| < \varepsilon$ such that **b** is strictly preferred to **a**.
Marginal rates of substitution (MRSs)	The rates at which consumers are willing to trade one good for another. It is the slope of an indifference curve.
Marginal rates of transformation (MRTs)	The rates at which the economy can transform one good into another. It is the slope of the production possibilities curve.
Market failure	When imperfections in markets, caused by externalities, imperfect competition, imperfect information or government intervention, result in a nonefficient allocation of resources.
Negative semidefinite matrix	A square matrix **B** whose quadratic form x^tBx is greater than or equal to zero for all **x**.
Consumption efficiency	All MRSs are equal so that there is no Pareto improving reallocation of consumption among consumers.
Opportunity cost	The value that must be given up (foregone) to acquire or obtain something.
Production efficiency	When all firms in the economy have the same MRT, and production is allocated between the firms so that it is not possible to produce one more good without producing less of another good.
Reflexivity	Each consumption bundle in the consumption set is weakly preferred to itself.

Revealed preference	An approach which derives demand relationships by observing consumers' choices with different prices and incomes, assuming that choices are rational.
Satisficing	Choosing the option that satisfies the most important needs, even though the choice is not optimal or ideal.
Strong monotonicity	If **a** $\geq$ **b** and **a** $\neq$ **b**, then **a** is strictly preferred to **b**.
Symmetric	A matrix with the same elements above and below the diagonal, i.e., $a_{ij}=a_{ji}$.
Transitivity	If **a** is weakly preferred to **b**, and **b** is weakly preferred to **c**, then **a** is weakly preferred to **c**, for all **a**, **b**, and **c**.
Willingness-to-accept (WTA)	The amount of money consumers will accept to forego a benefit or to trade a commodity.
Willingness-to-pay (WTP)	The amount of money consumers will pay to acquire a commodity.

INTRODUCTION

1.0 GENERAL BACKGROUND

The neoclassical economic paradigm predicts that an efficient allocation of resources which maximizes social welfare can be achieved when individuals make choices in their own best interests. Efficiency, however, occurs when competitive markets function properly[1]. Market failures can result in an under or over provision of resources. Government intervention may be necessary to restore resource allocation to an efficient level. Benefit-cost analysis provides a tool to compare the costs and benefits of proposed government intervention. However, monetizing potential benefits and costs of government proposals can be complicated.

Although prices provide a reference point for commodities that are traded in markets, it is more difficult to evaluate nonmarket goods and services. In these situations, monetary estimates of willingness-to-pay (WTP) are generally used. WTP measures the maximum amount consumers would be willing to pay for the next unit of the nontraded good or service in question. In other words, WTP measures the consumption value that consumers assign to an item.

Economists have developed several methods to estimate WTP for nonmarket goods, including travel-cost models, hedonic price models and contingent-valuation methods. Whereas travel-cost models and hedonic price models examine market behaviour to infer WTP for nonmarket goods, contingent-valuation methods directly elicit WTP from consumers. Some economists, however, believe that directly elicited valuation measures of nonmarket goods or services are biased and unreliable since they occur without the structure of markets that force consumers to reveal their true preferences.

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[1] Each point along an economy's utility possibilities frontier is efficient. Moreover, competition is a necessary, but not sufficient, condition for efficiency. For example, a competitive equilibrium achieved by fully functioning markets will be efficient, whereas a centrally planned economy can theoretically attain the same efficient allocation of resources in the absence of competitive markets.

1.1 PROBLEM STATEMENT

Empirical studies of economic decision making often produce results that are inconsistent with neoclassical economic theory. The mathematical framework underlying economic theory employs simplifying assumptions that may not describe real world behaviour. Moreover, behaviour elicited in hypothetical settings may be more susceptible to biases than market behaviour. Experiments that show how biases distort decisions can help economists construct better hypothetical experiments that predict real behaviour.

Although there have been an enormous number of valuation studies, few economic studies have intentionally induced biases in an experimental setting to examine their effects on consumer choice behaviour. The research described in this document concentrates on three different types of biases that may affect valuation measures: (1) information bias, (2) nonmonetary valuation bias, and (3) endowment effect bias. Experiments were designed to test (1) whether a framing bias would influence trading behaviour, and (2) whether bias-induced differences in willingness-to-pay could be linked to the effects of biases on the valuation of attributes.

1.2 HYPOTHESES TO BE TESTED

1.2.1 The Endowment Effect - A Framing Bias

Thaler (1980) observed that consumers will increase the value they assign to an item when it becomes part of their endowment. In other words, the amount they are willing to accept to trade the item will exceed the amount they had been willing to pay to acquire that same item. He labelled this behaviour the endowment effect. Similarly, psychologists Tversky and Kahneman (1981) observed that people often value losses differently than gains. They hypothesized that choice behaviour can be rationalized with a sigmoid shaped value function rather than the concave utility function commonly

used in economics. Their results showed that how a question is framed can influence a person's response.

For the research described in this thesis, an experiment was designed to examine whether the endowment effect could be induced and if experimental conditions would bias the behaviour. This experiment tested hypotheses that (1) transferring ownership of an item would induce an endowment effect, and if so, (2) changing the wording of instructions for the experiment would modify the effect.

1.2.2 The Effect of Biases on Willingness-to-Pay and Attribute Ranking

Psychologists and decision theorists use different paradigms than economists to study choice behaviour. Some of their models are based on a multi-attribute utility function similar to that proposed by Lancaster (1966). Using this approach, Gregory et al. (1992) compared different monetary and nonmonetary methods of value elicitation for public and private goods. They found that individuals could rank the benefit or importance of some goods more easily and consistently than they could assign WTP. Their results also suggested that the contingent valuation methodology (CVM) approach may not be able to elicit reliable values for certain types of goods.

Economic studies have focused on minimizing experimental biases in CVM surveys. As far as is known, however, none of these studies have examined whether biases have the same effect on public and private goods or on environmental and nonenvironmental goods. Consequently, an experiment was designed to examine the effects of two types of bias (1) information bias, and (2) nonmonetary value bias (i.e., a type of framing bias) on the valuation of twelve goods classified as either public or private and as either environmental or nonenvironmental.

First, it was hypothesized that if subjects were given information about sustainable development, their subsequent monetary valuation of environmental goods or services would be upwardly biased. In addition, this information was not expected to

change the amount subjects would be willing to pay for nonenvironmental items.

Second, it was proposed that framing questions to elicit an initial nonmonetary value (importance or benefit) for a nonmarket (public) good would bias any subsequent monetary valuation of that good. This effect was not expected to be observed for market (private) goods. Moreover, it was hypothesized that the effect of the value bias would persist, and influence how subjects ranked various attributes of nonmarket goods.

Additionally, it was hypothesized that (1) societal importance attributes would be correlated to WTP for more public goods than private goods, and (2) the value precision of private goods would be higher than for public goods. Finally, it was expected that personal importance and personal benefit scores would be positively correlated to WTP for private, but not public goods.

1.3 A BRIEF DESCRIPTION OF THE EXPERIMENTS

In Chapter 3, an experiment on the endowment effect using a candy bar and McGill coffee cup is described. Three different mechanisms were used to transfer ownership to the subjects: (1) Subjects initially given one item were allowed to trade for the other item; (2) Subjects chose between the two items; and (3) Subjects initially given both items were asked to give up the item they least preferred. Furthermore, different instructions for the first mechanism were used to try to modify the intensity of the endowment effect.

In Chapter 4, a second experiment is described that studied the effects of (1) an information bias and (2) a nonmonetary valuation bias on WTP. Six different questionnaires were designed to administer combinations of bias treatments. One part of the questionnaire required that subjects read a short document. At each experimental session, one-half of the subjects read a short excerpt from an Environment Canada publication on sustainable development. The other half of the subjects read a similar-length article from The Globe and Mail on new findings about the sinking of the Titanic.

At each session approximately one-third of the subjects were asked to rank the importance of twelve goods to them before they specified the monetary amount they would be willing to pay for the good. Similarly, one-third of the subjects were asked to rank the personal benefit received from the goods before indicating their WTP. Finally, the remaining subjects were only asked to indicate the amount they would be willing to pay for these goods. Following the WTP questions, all subjects ranked six attributes for each of the twelve goods.

1.4 JUSTIFICATION FOR APPROACHES TAKEN

Economic theories are based on heuristic assumptions about human behaviour. However, being a positive science, these theories should be judged on their ability to predict economic behaviour rather than on the validity of their assumptions. The assumptions of an economic model will dictate the circumstances in which the model can be used. Therefore, although a theory should be judged on its ability to predict, examining these underlying assumptions can undercover limitations in some theories. Experimental economics provides an approach to test some of these basic assumptions about consumer behaviour.

Valuation studies using contingent valuation methods try to minimize bias in their questionnaires. In a hypothetical setting, biases can distort the amount individuals state they would be willing to pay for the item being studied. In contrast, choices made in competitive markets are assumed to be unbiased. This suggests that biases could affect WTP for market and nonmarket goods differently. For this thesis, experiments were designed to test the effect of biases on valuation of public, private, environmental and nonenvironmental goods. Because the purpose of the experiment was to test how biases affected value, a reasonably homogenous group of subjects was desirable. Consequently, undergraduate students from McGill University were recruited as subjects.

LITERATURE REVIEW

2.0 OVERVIEW

Economics is a discipline that uses mathematical models to study human behaviour. Thus, the current chapter begins with an examination of the mathematical framework for consumer choice models. This is followed by sections on the valuation of market goods and of public goods. Within the section on public goods, evaluation of environmental goods is examined in more detail. Next, there is a description of direct valuation techniques, with an emphasis on contingent valuation methods. This is followed by a brief discussion of potential biases that can affect value elicitations, including the endowment effect. The chapter closes with a section describing other views of the valuation process.

2.1 THE MATHEMATICAL FRAMEWORK FOR UTILITY MAXIMIZATION THEORY AND CHOICE BEHAVIOUR

The economic model of consumer behaviour assumes that decisions are governed by individual preferences. Consumption, however, is always bounded by limited resources. All individual economic choices are constrained by the consumer's budget set:

$$B = \{\mathbf{x} \in X : \mathbf{p}\mathbf{x} \leq m\},$$

where X is the set of all possible consumption bundles faced by the consumer, **x** an n-dimensional vector of goods that constitute the consumption bundle, **p** an n-dimensional price vector for **x**, and m the consumer's income (Varian 1992).

Neoclassical utility maximization theory describes the ordered preferences that underlie individual choice behaviour. The model is deduced *a priori* from the rationality postulate in which well-behaved preferences satisfy five properties: (1) completeness, (2) reflexivity, (3) transitivity, (4) continuity, and (5) strong

monotonicity (Blaug 1992, Varian 1992). The constrained utility maximization problem can be stated as:

$$\begin{aligned} &\text{maximize } u(\mathbf{x}) \\ &\quad \text{subject to } \mathbf{p}\mathbf{x} \leq m \\ &\quad \mathbf{x} \in X, \end{aligned}$$

where u is a continuous concave utility function representing preferences that satisfy the five axioms. Assuming prices are positive and income is nonnegative, the constraint set (i.e., the budget set) would be compact, a requirement for the existence of a solution to any optimization problem (Varian 1992). In addition, preferences are normally assumed to be convex, i.e., mixes are preferred over extremes (Varian 1992). While it can be proven mathematically that a solution to the utility maximization problem exists, utility cannot be observed or measured directly. To develop a testable model of consumer choice behaviour it is necessary to define utility in terms of observable parameters.

Assuming local nonsatiation of preferences, the budget constraint becomes an equality at the optimum. The solution to the utility maximization problem lies on the budget line and can be found with the Lagrangian technique. The Marshallian demand, $\mathbf{x}^*$, is the vector of goods derived from the first order conditions of the Lagrangian function that maximized utility. Whereas utility is unobservable, the Marshallian demand function, $\mathbf{x}(\mathbf{p},m)$, and its parameters can be observed. Applying the envelope theorem to the Lagrangian function, the consumer choice problem can be restated in terms of a value function. The indirect utility function, $V(\mathbf{p},m)$, relates *optimal utility* to prices and income:

$$\begin{aligned} V(\mathbf{p},m) = \max\ & u(\mathbf{x}) \\ & \text{subject to } \mathbf{p}\mathbf{x} = m. \end{aligned}$$

Like other economic models, consumer choice can also be described in terms of expenditure minimization, the dual of utility

maximization. The concave expenditure function, $e(\mathbf{p},u)$, relates minimized expenditures to prices and utility (Varian 1992, Kolstad and Braden 1991):

$$e(\mathbf{p},u) = \min \mathbf{px} \quad \text{subject to } u(\mathbf{x}) \geq u.$$

The consumption bundle that solves the expenditure minimization problem is called the Hicksian demand. This formulation of the consumer choice problem, however, suffers from the same limitations as utility maximization: the Hicksian or compensated demand function, $h(\mathbf{p},u)$, is not observable. However, at the optimum and under the assumptions of local nonsatiation of preferences and a compact constraint set, two identities hold:

$$e(\mathbf{p},\bar{u}) = m$$
$$v(\mathbf{p},m) = \bar{u}.$$

Expanding these identities,

$$e(\mathbf{p},v(\mathbf{p},m)) = m$$
$$v(\mathbf{p},e(\mathbf{p},\bar{u})) = \bar{u}.$$

the link between observable and unobservable behaviour can be shown. Moreover, when utility is maximized or expenditures are minimized, the Marshallian demand and Hicksian demands will be equal (Varian 1992),

$$x_i(\mathbf{p},m) = h_i(\mathbf{p},v(\mathbf{p},m))$$
$$h_i(\mathbf{p},\bar{u}) = x_i(\mathbf{p},e(\mathbf{p},\bar{u})).$$

Figure 2.1 shows the mathematical relationships between the equations that form the framework for consumer choice models.

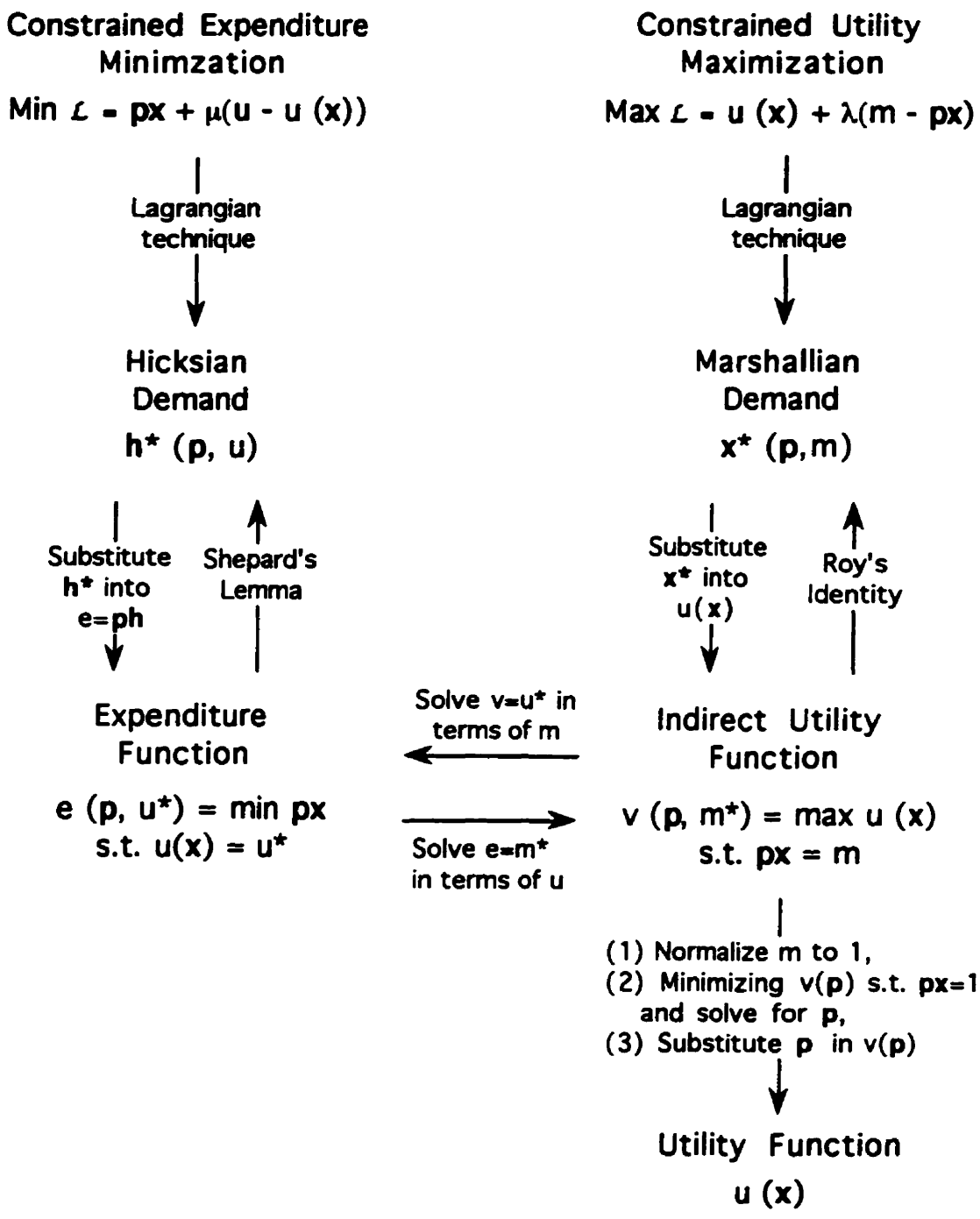


FIGURE 2.1. Mathematical Relationships In The Consumer Choice Model

Moreover, the Slutsky equation,

$$\frac{\delta x_i(p,m)}{\delta p_i} = \frac{\delta h_i(p,v(p,m))}{\delta p_i} - \frac{\delta x_i(p,m)}{\delta m} x_i(p,m),$$

decomposes observable changes in demand caused by a change in price into unobservable substitution and observable income effects (Varian 1992, Kolstad and Braden 1991). Substitution effects are changes in Hicksian demand (i.e., utility is kept constant) in response to a change in price. The matrix of Hicksian substitution effects (elements = $\delta h_j(p,u)/\delta p_i$) is also the Hessian matrix (i.e., second order conditions) of the expenditure minimization problem. Since the expenditure function is concave, it can be shown that the substitution matrix is a symmetric, negative semidefinite matrix. Thus, it can be inferred that substitution effects are always negative and the Hicksian demand curve is downward sloping.

Income effects can be thought of as changes in Marshallian demand in response to a change in "purchasing power" (Varian 1992). When prices change, consumers can afford different bundles, as though their incomes had changed and prices remained constant. Income effects, therefore, correspond to points along the consumers' income expansion paths and can be negative or positive depending on the goods chosen. Moreover, regardless of the sign of the effect, if the income effect has a smaller magnitude than the substitution effect, the demand curve for the particular good in question will be downward sloping.

Revealed preference is a way to make inferences about a consumer's underlying preferences. From a set of affordable consumption bundles, a utility maximizing consumer will select the bundle with the highest level of utility. For example, if x^a was chosen over x^b, then $p^a x^a \geq p^a x^b$, and x^a is "revealed preferred" (denoted as R) to the alternative bundle (Varian 1992, p. 132). Furthermore, the relationship x^a R x^b implies that $U(x^a) \geq U(x^b)$, and conversely, $U(x^b)$ is not greater than $U(x^a)$. A stronger relationship exists if a bundle is "strictly directly revealed preferred" (denoted

as P^D) to an alternative. In this case, the relationship $x^b P^D x^a$ implies that $p^b x^b > p^b x^a$ and $U(x^b) > U(x^a)$. The Generalized Axiom of Revealed Preference (GARP) states:

$$x^a R x^b \Rightarrow \text{not } x^b P^D x^a,$$

$$x^a R x^b \Rightarrow \text{not } p^b x^b > p^b x^a,$$

$$x^a R x^b \Leftrightarrow p^b x^b \leq p^b x^a,$$

(Varian 1992). According to Afriat's theorem, GARP is a sufficient condition for utility maximization and it can be inferred that "there exists a locally nonsatiated, continuous, concave, monotonic utility function that rationalizes the data" (Varian 1992, p. 133). With convex preferences (i.e., mixes preferred to extremes) and a concave utility function, diminishing marginal utility can also be inferred. Thus, the mathematical framework presented above can be used to indirectly study preferences controlling the choices that consumers make in response to different price vectors or changes in income.

2.2 EFFICIENCY AND VALUATION OF MARKET GOODS

At equilibrium, an economy is Pareto efficient when its resources are allocated so that no person can be made better off without making someone else worse off (Rosen 1995). Pareto efficiency requires (1) consumption efficiency, (2) production efficiency (including technical efficiency), and (3) allocative efficiency. These three efficiencies exist when all consumers have the same marginal rates of substitution (MRSs) and MRSs equal relative prices; marginal rates of transformation (MRTs) are the same for all firms and MRTs equal relative marginal costs; and MRTs equal MRSs.

If marginal rates of substitution are equal for all consumers, individual demand curves for market goods can be summed horizontally to obtain commodity demand curves. These curves

describe the relationship between aggregate consumer demand and price for a given commodity at a given time in a given market. Demand curves also reveal the maximum amount consumers would be willing to pay for each additional unit of the commodity.

Analogous to demand, supply curves for all firms in an industry can be summed horizontally to derive the industry supply curve for market commodities. This industry curve not only represents the relationship between price and quantity supplied but specifies the minimum amount firms would accept to supply an additional unit of the commodity. With flexible prices, the competitive supply and demand equilibrium for a traded good determines the market price of that commodity. Consequently, at equilibrium, the amount consumers are willing to pay equals the amount sellers are willing to accept.

Efficiency only occurs when competitive markets function properly. Externalities, imperfect or asymmetric information, natural monopolies or market power can produce market failures causing an under or over provision of resources. Government intervention may be necessary to correct market failures and restore resource allocation to an efficient level. Furthermore, most government actions have costs associated with them. Benefit-cost analysis provides a tool to evaluate the social and financial costs and benefits of a proposed government intervention. However, monetizing potential benefits and costs of government proposals can be complicated. Although prices provide a reference point for commodities that are traded in markets, often the policy or project under consideration requires evaluation of nonmarket goods and services.

2.3 VALUATION OF PUBLIC GOODS

No price signals exist for goods that are not traded in markets. This is especially true for *public goods* like national defence or resources with communal property rights such as public parks. Commodities can be classified as public goods depending on many factors including property rights, market conditions and existing

technologies. Two characteristics are frequently associated with public goods: nonrivalry and nonexcludability. Nonrivalry means that "one person's consumption does not reduce the amount available to other consumers" (Varian 1992, p. 414). Consumption is nonexcludable "when it is either very expensive or impossible to prevent anyone from consuming the good who is not willing to pay for it" (Rosen 1995, p. 62). Varian (1992) defines public goods as completely nonrival and nonexcludable in consumption, whereas Rosen (1995) defines pure public goods as nonrival in consumption. Randall (1981) avoids the public good label entirely, preferring to classify goods based on their degree of rivalry and excludability.

In contrast to market goods, at equilibrium the marginal rates of substitution for public goods or publicly provided private goods can be different for each consumer. The necessary condition for Pareto efficiency becomes:

$$\sum_{i=1}^{n} MRS^{i} = MRT$$

where n is the number of people in the economy. In this case, the societal demand curve for the public good is derived by vertically summing the individual demand curves. If societal demand equals MRT, the public good will be provided in an efficient level.

In Canada, provision of public goods is often determined indirectly via the political process. Individuals vote for a political party with stated policies consistent with their preferences for public goods and services. Election results can give a government an indication of public preferences, but this does not indicate the intensity of preferences. Moreover, there are no guarantees that once in power the political party will provide public goods at an efficient level. More likely, public goods will be provided at politically popular levels. To formulate effective public policy, it is necessary that governments have a mechanism to measure the amount consumers would be willing to pay for public goods such as environmental resources or health and safety programs.

Since public goods are rarely provided in markets, values must be derived from the actions of consumers. Environmental goods, however, present a problem since they can have multiple values.

2.3.1 The Value of Environmental Goods

Unlike consumption goods, environmental goods can provide benefit to society even when they are not used. Environmental economists recognize that monetary valuation of environmental goods embodies both use and nonuse values (Pearce 1993). Similar to marketed goods, use value measures the consumption value of an environmental good to the consumer. Nonuse value, however, can be subdivided into option and existence value. Option value is the benefit from knowing that the good is available for use in the future by the consumer, future generations (bequest value) or other individuals (vicarious value) and existence value is the benefit from knowing the good exists without any expectation of future use of the good. The sum of the use value, option value and existence value is the total economic value (TEV) of the environmental good (Pearce and Turner 1990).

2.3.2 Direct Valuation Techniques

Direct valuation techniques infer monetary value for nonmarket goods from the behaviour of consumers. One approach is to find a surrogate market in which traded goods have quantifiable characteristics that match those of the nonmarket goods. For example, if a job entails certain health risks, wage differentials can be used to estimate the opportunity cost of that risk. Travel-cost models and hedonic pricing models both use the surrogate market approach. These models have been employed in many situations, including land-use planning, recreational resource allocation decisions, and risk assessment.

An experimental approach can also be used to estimate the value of nonmarket goods. A hypothetical market is simulated in an experimental setting to directly elicit a monetary value for the nonmarket good. Contingent valuation method (CVM) is an example of

such an experimental approach. Each of the direct valuation techniques can be used to determine use values, but only the experimental approach can yield an estimate of nonuse values (Portney 1994).

2.3.2.1 Contingent Valuation Methods

With CVM, researchers utilize surveys or questionnaires to find out the amount individuals would be willing to pay (or WTA) for a change in the level of provision of some public good. When property rights are clearly defined, willingness-to-accept (WTA) can also be used to measure potential benefits. WTA is the minimum monetary amount that the owner of the property right will accept to forego a certain benefit or to tolerate a loss of a benefit. Like willingness-to-pay, WTA measures the opportunity cost of a particular good or service. All valuation methods assume that willingness-to-pay and willingness-to-accept reflect individual preferences and are equal at equilibrium. Some empirical studies, however, have shown a disparity between WTP and WTA that seems to contradict this assumption. Brookshire and Coursey (1987) showed that this disparity decreased when individuals participated in market-like auctions. Moreover, they suggested that WTP yields a less variable measure of value for hypothetical questions.

This method has achieved a degree of respectability as evidenced by the many CVM studies that have been conducted throughout the world. For instance, Davis and O'Neill (1992) conducted a study to estimate the recreational value of access to angling sites in Northern Ireland. Whittington et al. (1991, 1993) determined household demand for sanitation services in Ghana and improved water systems in Haiti. In Tunisia, McPhail (1994) measured demand for improved water systems, and Kwak and Russell (1994) determined the demand for protection of water quality in Korea. In Australia, CVM has been used to evaluate the benefits of conservation of natural resources (Carson et al. 1994).

In North America, numerous CVM studies have been conducted to estimate the value of environmental quality improvements and

environmental damage assessment (Hagen et al. 1992, Sun et al. 1992, Smith 1993, Loehman et al. 1994, Smith 1994). Furthermore, in the United States, Executive Order 12866 requires federal regulatory agencies to perform economic impact analyses for any major regulation (U.S. Office of Management and Budget 1996). Direct valuation techniques are frequently used to estimate the benefits of proposed regulations. Recently, CVM has been adopted by the U.S. Department of Interior as the best available method to calculate natural resource damage (Cummings and Harrison 1994) and is increasingly being used for damage litigation (Portney 1994).

Despite the plethora of CVM studies, many economists still believe that these studies are internally inconsistent and do not measure preferences (Hausman 1993, Diamond and Hausman 1994). The hypothetical nature of these studies raise concerns about whether the values they elicit are *real* economic values (Cummings and Harrison 1994). Nonmarket goods have no real world data against which the results of surveys can be calibrated. Critics of CVM stress that survey results must therefore be evaluated for validity, reliability, bias, credibility and precision (Hausman 1993, Neill et al. 1994).

Diamond and Hausman (1994) speculated that consumers do not have preferences for unknown environmental goods. In their criticism of CVM, they concluded that without preferences, surveys eliciting monetary values will be inconsistent, which has been observed. Moreover, these observations suggest that the standard model of choice for market goods may not be adequate to predict consumption decisions involving nonmarket goods.

2.3.2.2 Biases in Experimental Economic Studies

Researchers have identified several types of bias that may contribute to false statements of value on valuation surveys, including starting point bias, vehicle bias, and information bias (Cummings et al. 1986; Mitchell and Carson 1989), as well as hypothetical biases such as framing effects (Tversky and Kahneman 1981). Some biases may arise from the design of the questionnaire.

Starting point bias can occur when a bidding game is used to elicit WTP. The first bid suggested by the experimenter may influence the subject's ultimate response. Vehicle bias occurs when subjects change WTP depending on the proposed type of payment such as taxes or user fees. Sometimes, the information provided in the questionnaire can distort WTP.

Moreover, the hypothetical nature of CVM studies can create biases. Market transactions reflect consumer preferences since they involve real commodities and real payments. However, there is no way to know with certainty that choices made in a hypothetical setting reflect preferences. In addition, the framing of the question can elicit completely different values for the same nonmarket good.

2.3.3 The Endowment Effect

Economic theory predicts that consumer WTP will equal seller WTA in an efficient economy with costless transactions. However, Thaler (1980) described situations where consumers appear to increase the value they assign to an item once they consider it part of their endowment. He labeled this behaviour the "endowment effect" and defined it as the "underweighting of opportunity costs." That is, out-of-pocket expenses are valued more than opportunity costs.

Knetsch and Sinden (1984) demonstrated the endowment effect in a laboratory experiment with lottery tickets and cash. Subjects showed a reluctance to trade the item they were initially given. While some studies have shown that repeated trades in a market setting can reduce the difference between WTP and WTA (Brookshire and Coursey 1987, Knez et al. 1985), other experiments continue to find evidence of an endowment effect (Kahneman et al. 1991, Kahneman et al. 1990, Knetsch 1989, Knetsch and Sinden 1984).

In another experiment, Knetsch (1992) gave ball point pens to one group of subjects and asked them to specify WTA to give up the pens. Another group of subjects received cash, then specified WTP to acquire the pens. Two intersecting curves were obtained from this experiment. Knetsch hypothesized that these curves

represented indifference curves that did not seem to be reversible as predicted by economic theory.

Kahneman and Tversky (1979) presented a theory of consumer choice, called prospect theory, which uses a value function rather than a utility function to predict choice behaviour. Their value function is concave for gains from a starting reference point but is convex for losses from that same reference. If the trade involves a loss from the reference point (i.e., giving up a good that one owns) the value assigned to the loss will be greater than if the trade involved a gain (i.e., money was used to purchase a good). The major implication of prospect theory is that preferences will depend on a reference point and how the choice problem is framed (Plous 1993). Thaler (1991) has gone as far as suggesting that the assumption of stable preferences in economic theory should be adapted to allow for preference ordering from a reference point. While economists have examined these anomalies of choice theory, other social scientists have been looking at these same questions with different paradigms.

2.4 OTHER VIEWS OF VALUATION

Many empirical studies of choice under uncertainty have observed preference-reversal behaviour (Thaler 1991). Slovic and Lichtenstein (1983) reviewed the limitations of economic theory in terms of information-processing, and suggested that observations of preference reversal in economic experiments were not isolated occurrences but rather highlighted the need to reexamine the rational choice theory. Psychologists explain such paradoxes as framing and anchoring effects inherent in the experimental situation. Furthermore, these observations suggest that behaviour is situation specific and dependent on the information available to the consumer.

Simon's bounded rationality (Heap et al. 1992) proposed that when faced with unfamiliar choices, consumers will use short-cuts, drawing on past experiences, rather than incur the cost of gathering and evaluating new information. Simon predicts that individuals make "satisficing" rather than optimizing decisions, frequently

accepting the second best (or less) outcome. Bounded rationality provides an explanation for why individuals make seemingly irrational choices in situations with a continuous flow of new information, a phenomenon becoming increasingly more common in the modern world.

Fischhoff (1991) described different paradigms used by social scientists studying valuation. At one end of the spectrum, the philosophy of articulated values assumes that people know the answer to any question posed to them. Researchers accepting this paradigm are preoccupied with assuring that questions are correctly formulated and understood so that strategic behaviour is minimized. Most neoclassical economic studies fall into this paradigm.

At the other side of the spectrum, the philosophy of basic values assumes that individuals have a set of basic beliefs about well-known situations from which they can infer values for lesser-known situations. Decision researchers following this paradigm build models with multi-attribute utility functions which encourage subjects to thoroughly consider the value of each of the attributes of an item. There are intermediate positions between these two philosophies.

Fischhoff (1991) also identified the costs associated with eliciting values with the wrong paradigm. He postulated that if it is assumed that individuals have well defined values (articulated or partial perspectives) when in reality their opinions are less well defined (basic values), elicited amounts can be meaningless and researchers may incorrectly accept the results. Conversely, if researchers assume that opinions are less well defined than they actually are, the study will be excessively complicated and also lead to inaccurate responses.

The neoclassical view of stable preferences does not account for complex choices between many alternatives or conflicting values. Among psychologists there is growing support for a theory of decision making based on constructed preferences (Payne et al. 1992). In contrast to economic models, psychologists assume labile preferences. Depending on the situation, consumers will "construct" preferences that allow them to make decisions.

Gregory et al. (1995) examined the precision of monetary values for environmental improvements. Their study found that subjects did not have a precise idea of monetary value, suggesting that consumers did not have exact preferences for nonmarket environmental goods. However, subjects could specify a range of acceptable monetary amounts that they would be willing to pay for these improvements, suggesting the ability to determine an ordinal ranking of alternatives.

If preferences are not well-defined for all types of commodities, individuals may assign monetary values that appear to be intransitive and susceptible to bias. In the following chapters, two experiments are described that will address the question of whether intentionally induced biases can influence economic decision making behaviour.

EXPERIMENTAL EVIDENCE OF AN ENDOWMENT EFFECT

3.0 INTRODUCTION

Economists develop models to study the behaviour of economic agents and firms. The consumer choice model assumes that individuals make decisions based on preferences. Rather than answering the question of how consumers determine their preferences, economists postulate that economic decisions maximize utility.

A utility function is a mathematical representation of consumer preferences. It is assumed that preferences have certain mathematical properties which allow economists to deduce a utility function. Despite its mathematical elegance, utility can not be directly observed or measured.

Within the neoclassical economics paradigm, theories are supposed to be judged on their ability to predict economic activity. Any theory failing to predict accurately should be discarded (Blaug 1992). However, often when observations of economic activity contradict an accepted theory, questions are raised about experimental bias.

Thaler (1980) has observed that consumers will increase the value they assign to an item when it becomes part of their endowment. He labeled this behaviour the endowment effect. In contrast, economic consumer theory predicts that agents assign the same value to an item, regardless of ownership. Although the endowment effect has been observed in many experimental settings (Kahneman et al. 1991, Kahneman et al. 1990, Knetsch 1992, Knetsch 1989, Knetsch and Sinden 1984, Ortona and Scacciati 1992), it is still considered an anomaly by the general economic community (Kahneman et al. 1991).

Research that demonstrates the effects of biases on decision making can help economists evaluate the robustness of behaviours such as the endowment effect. Thus, an experiment was designed to

examine whether the endowment effect could be induced and if experimental conditions would bias the behaviour. This experiment tested two hypotheses:

1. Transferring ownership of an item would induce an endowment effect;

2. Changing the wording of instructions for the experiment would modify an endowment effect, if it exists.

3.1 METHODS

3.1.1 Subjects

One hundred and sixty-seven undergraduate students were paid $10 for their participation in this experiment. Students were randomly recruited at the downtown campus of McGill University in Montreal, Canada. Individuals who consented to be subjects signed up in advance for a specific date and time. Even though students were telephoned the day before the experiment, turnout was unpredictable. Additional students were also recruited on the day of the experiment. Immediately before starting the experiment, each student signed a consent form in accordance with McGill University's guidelines for nonmedical research involving human subjects.

Approximately two-thirds of the subjects were female (109 subjects) and 58 participants were male. A majority of subjects were between 20 and 22 years of age, and ninety-six percent were between 17 and 25 years old (Figure 3.1).

Individuals participating in the experiment were earning degrees in several disciplines. The percentage of students in each area ranged from 28.7% in the social sciences to 13.2% in the

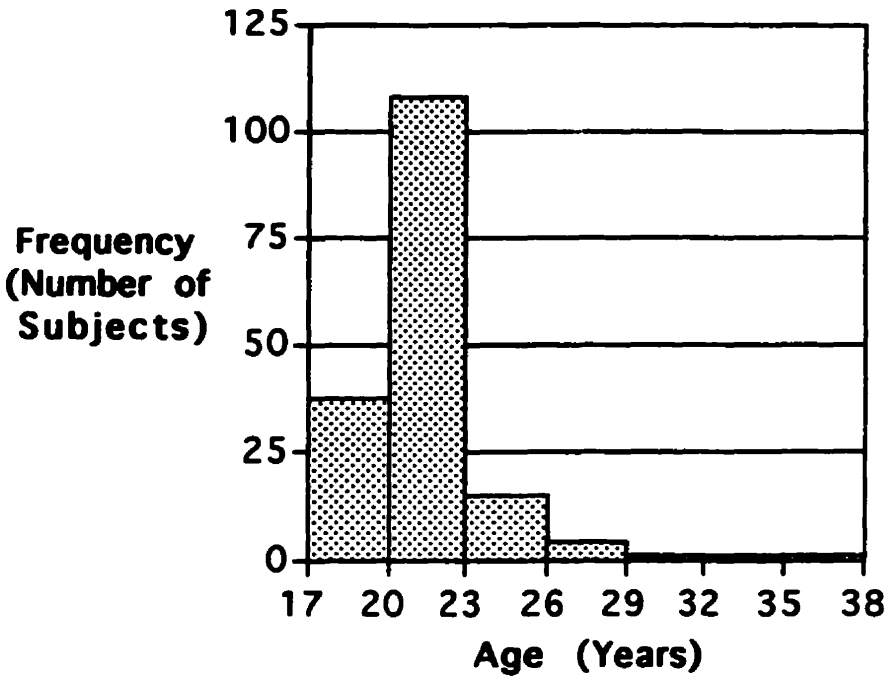


FIGURE 3.1. Frequency Distribution Of Subjects By Age

humanities (Table 3.1). Most students were either U2 or U3 (i.e., second or third year of an undergraduate program). However, thirteen percent had just completed their studies at McGill (Table 3.2).

At the time of the experiment, about two-thirds of participating individuals (113) resided in the city of Montreal. Just over half of all subjects (87) responded that they lived with members of their family (Table C1 in Appendix C).

McGill University is an English-language university in the province of Quebec. Not surprisingly, the vast majority of the subjects principally spoke English (147). Nevertheless, seventy-two percent considered themselves to be bilingual in both French and English (Table C2 in Appendix C).

Table 3.1. Area of Study at McGill University

Area:	Number of Students	Percent of Students
Social Sciences	48	28.7%
Biological and Health Sciences	35	21.0%
Physical Sciences and Engineering	29	17.4%
Management	24	14.4%
Humanities	22	13.2%
Other	9	5.4%
TOTAL	167	100.0%

Table 3.2. Year Enrolled at McGill University

Year	Number of Students	Percent of Students
U1	11	6.6%
U2	65	38.9%
U3	59	35.3%
U4	4	2.4%
Post-Baccalaureate Studies	3	1.8%
Just Graduated	22	13.2%
No Response	3	1.8%
TOTAL	167	100.0%

3.1.2 The Experiment

3.1.2.1 Physical Set-up for the Experiment

All experiments were conducted in the same classroom in the McLennan-Redpath Library complex, which was chosen for its central location on the downtown campus. For each session, several long tables were arranged identically with a questionnaire, an instruction sheet, and a pencil for each subject. At least one empty place was left between each person participating in the experiment.

The experiment was conducted over a ten-day period in May 1994 (Table 3.3). Poor turnout for the morning session on May 16 (Group 1b), required that this group be repeated on May 25. Times of the sessions were selected to fit with the undergraduate class schedule.

Table 3.3. Experimental Dates and Times

	16 May Monday	17 May Tuesday	18 May Wednesday	19 May Thursday	25 May Wednesday
09:00	Group 1b	Group 4			
12:30	Group 1a	Group 3	Group 2a	Group 2b	Group 1b

3.1.2.2 Goods Used to Induce the Endowment Effect

Two private market goods, a chocolate bar and a coffee cup, were selected to test the first hypothesis of the experiment. Both goods cost approximately the same dollar amount. These specific items were chosen because university cups and candy bars were used in previous experiments at Cornell University and Simon Fraser University (Kahneman et al. 1990).

The cup was made of red insulated plastic with the McGill University crest stamped on its side. Its dimensions were fourteen and one-half centimetres high and eight and one-half centimetres in diameter. A 400 gram imported milk chocolate bar from Eaton's department store was selected over equivalently-priced smaller (50-100 gm) brand-name bars. Wrapped in dark blue packaging, the Eaton bar measured 28 cm in length, 11 cm in width and 1.5 cm in thickness. Both items were available in Montreal.

3.1.2.3 Instructions

The second hypothesis being tested predicted that insertion of a key phrase in the written instructions would modify the extent of the endowment effect. Six sets of instructions were used for the experiment (see Appendix A for sample instructions). Only one set of instructions was given to a group of subjects. Depending on the group, an item was placed to the right of the questionnaire before the session began (Table 3.4).

Once instructions were given, subjects completed the first section of a questionnaire. This section contained ten lottery and judgment questions (see Appendix B). Approximately ten minutes later, after everyone completed section one, subjects were given the opportunity to trade (groups 1a, 1b, 2a, 2b), select (group 3), or give up (group 4) the chocolate bar or cup. Trades and choices were recorded for each group.

Table 3.4. Instruction Wording Treatments

Wording Treatment Group	Instructions and "Endowment" Item
1a	**Key wording:** "THE COFFEE CUP IS YOURS TO KEEP WHEN YOU LEAVE" **Item:** Red plastic insulated mug with the McGill University crest.
1b	**Key wording:** "THE CANDY BAR IS YOURS TO KEEP WHEN YOU LEAVE." **Item:** 400 g milk chocolate bar in blue packaging from Eaton
2a	**Key wording:** "YOU WILL BE ABLE TO TRADE THE COFFEE CUP FOR A 400GM MILK CHOCOLATE CANDY BAR." **Item:** Red plastic insulated mug with the McGill University crest.
2b	**Key wording:** "YOU WILL BE ABLE TO TRADE THE CANDY BAR FOR A PLASTIC MCGILL COFFEE CUP." **Item:** 400 g milk chocolate bar in blue packaging from Eaton
3	**Key wording:** *none* **Item:** *Without forewarning*, choose between the red plastic insulated mug with the McGill University crest and the 400 g milk chocolate bar in blue packaging from Eaton
4	**Key wording:** "...you must give up EITHER the candy bar or the coffee cup. However, THE ITEM YOU DO NOT GIVE UP IS YOURS TO KEEP WHEN YOU LEAVE." **Item:** Red plastic insulated mug with the McGill University crest **AND** 400 g milk chocolate bar in blue packaging from Eaton

3.1.3 Statistical Analysis

Each treatment was carried out on a different group of subjects. Even though these samples are independent, the subjects came from the same population of students. Therefore, an analysis of the six independent samples using a chi-square test was performed (Snedecor and Cochran 1980). The null hypothesis for this test was that all treatment groups were equal. The alternate hypothesis was that at least one treatment group was different.

If the global null hypothesis was rejected, multiple comparisons between treatment groups were made to determine which groups were different. Critical z-values were adjusted according to the Bonferroni inequality to reduce the possibility of Type I error.

3.2 RESULTS

3.2.1 Experimental Evidence of an Endowment Effect

When offered a choice between two items of similar value, individuals will pick the item they most prefer. Therefore, approximately half of the subjects were expected to choose the cup. However, the results indicated that the cup was much more popular with subjects who had a choice, preferred by more than four to one (Figure 3.2A).

If there was no endowment effect, the percentage of subjects that selected the cup would be the same regardless of any endowment. No statistical difference between subjects endowed with the cup (80.4%) and individuals who freely chose the cup (83.6%) was found (Figures 3.2A and 3.2B). However, subjects who received an endowment of the chocolate bar behaved differently than the other subjects. The percentage of people that kept the candy (42.6%) was 2.6 times the percentage of people that chose the candy (16.4%). At the 5% level, these two groups are statistically different (Figures 3.2A and 3.2B).

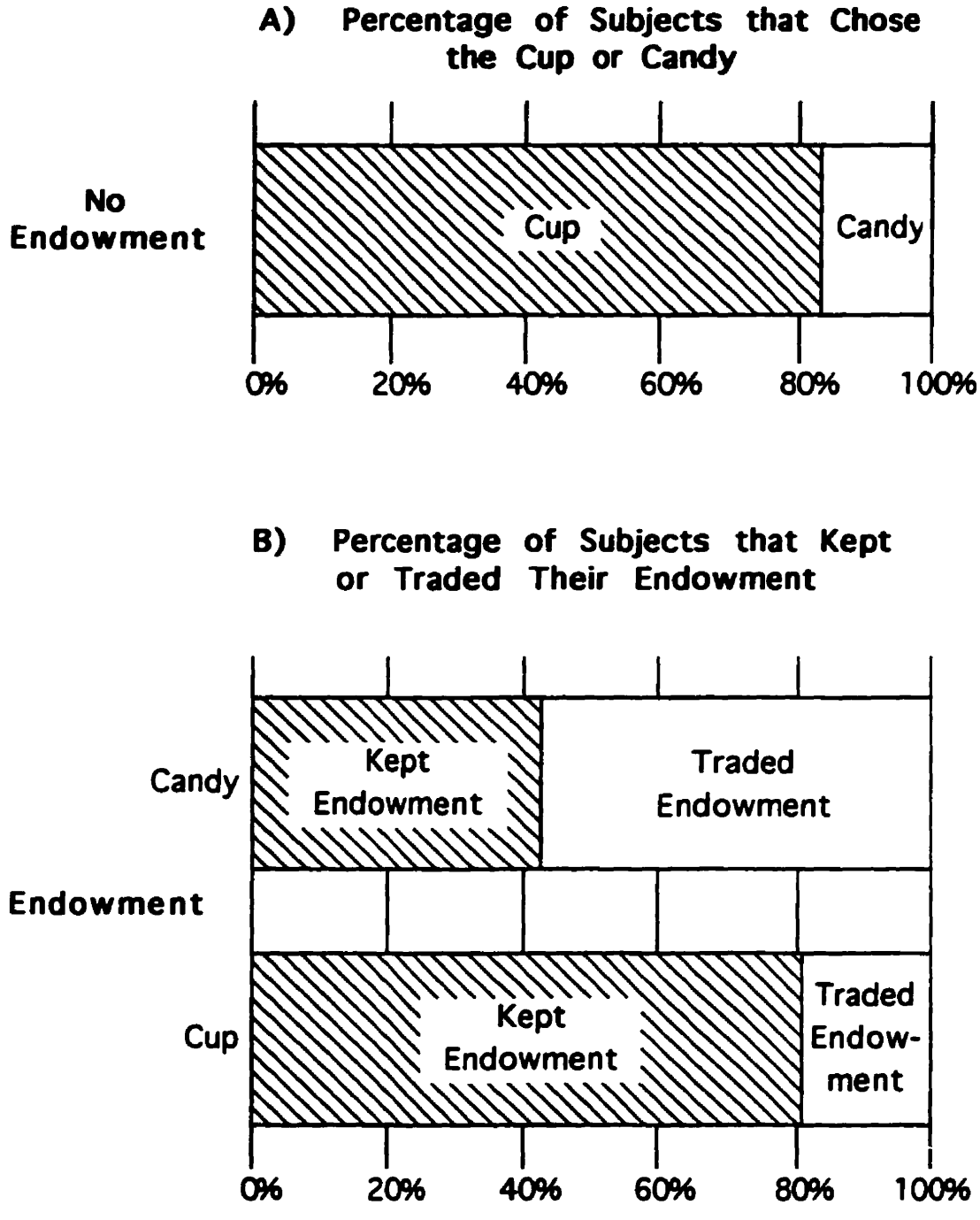


FIGURE 3.2. Evidence Of The Endowment Effect

3.2.2 Instruction Wording Failed to Modify the Endowment Effect

The second hypothesis dealt with the effect of wording on the endowment effect. Language specifying a transfer of ownership was expected to induce an endowment effect. Furthermore, it was thought that informing subjects about the opportunity to trade the item received at the outset of the experiment would increase the number of trades, thus reducing the endowment effect. Two choice groups were used as controls. One group was allowed to consider the choice for approximately ten minutes while the other group was asked to make an immediate choice, without time for reflection. Pairwise comparison tests between the treatment groups showed that although an endowment effect was observed, wording had no effect on it (Figure 3.3). These results reject the second hypothesis and suggest that the endowment effect is not easily modified by experimental instructions.

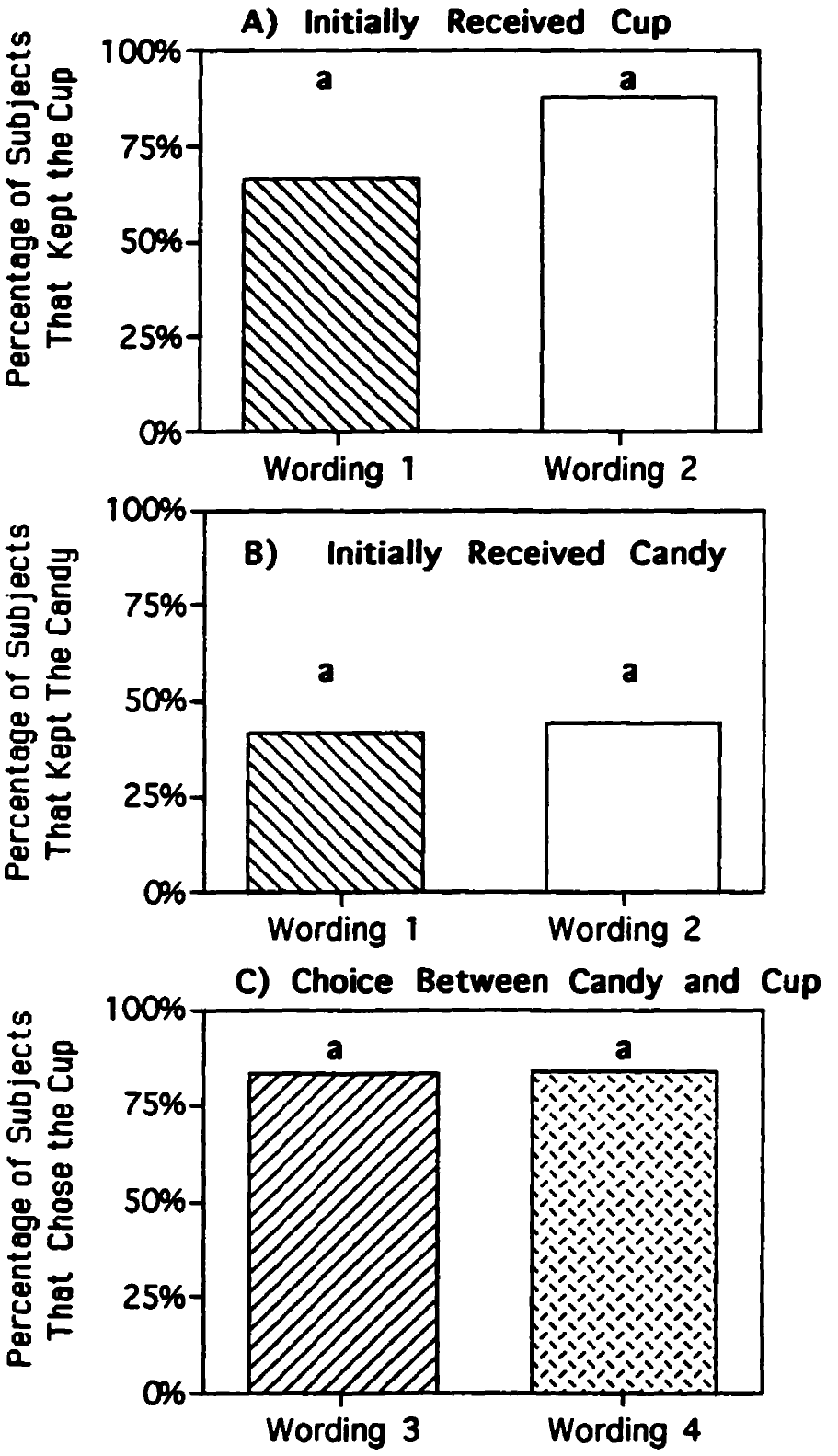


FIGURE 3.3. The Effect Of Wording On The Endowment Effect
The four wording treatments are defined in Table 3.4. For each sub-figure, bars with the same letter above them are not significantly different at $p<0.05$.

3.3 DISCUSSION

The standard economic model of consumer behaviour assumes that individuals make decisions based on preferences which maximize utility. The ordinal concept of utility is key to understanding this theory. Economic agents have a consumption set that contains all possible combinations of goods and services. The set is assumed to be closed and convex, with only nonnegative elements. Preferences, therefore, determine the ordered relationship between the elements in the consumption set.

Several mathematical properties such as transitivity, completeness, reflexivity, continuity, local nonsatiation, monotonicity and convexity characterize well-behaved preferences. Economists have proven mathematically that a utility function exists which describes well-behaved preferences when all of the properties hold (Varian 1992). Thus, utility is a mechanism by which possible choices of rational economic agents can be ranked.

Utility maximization implicitly assumes that well-behaved preferences are the norm. When faced with alternatives, agents compare options, choosing the one that yields the highest utility. While the idea of utility maximization may work as a normative theory, evidence of behaviours such as the endowment effect seriously challenge the theory's explanatory powers.

In this experiment, behaviour was observed that was not predicted by economic theory. Individuals electing to keep the chocolate bar increased from 16.4% to 42.6% after the candy became part of their endowment. Similar behaviour was observed by Lowenstein and Kahneman (cited in Kahneman et al. 1991) who found the percentage of students choosing a pen rather than two chocolate bars increased from 24% to 56% when the pen was received first. More dramatic results were obtained by Knetsch (1992). Ninety percent of the subjects endowed with a pen kept it rather than trade for a mug plus five cents.

In trades involving goods and money, Knetsch and Sinden (1984) found that the percentage of students who chose to pay $2

for a lottery token was 50%. However, 76% of the students who were given the token for the experiment refused to trade it for $2. In experiments conducted at Cornell University, students given a Cornell mug stated a median reservation price almost twice that of students who were not given the mug (Kahneman et al. 1990). The difference between buyer's and seller's reservation prices persisted when the item was changed to a pen. In both cases, trades occurred much less frequently than had been expected. Using a fixed price lot mechanism to elicit value, Ortona and Scacciati (1992) found, in contrast, that Italian students stated the same median reservation price for a book voucher, regardless of whether they had been given the voucher or given the choice between the voucher and money.

Although equivocal, many experiments provide evidence that transfers of ownership (i.e., endowment of a good) can induce an endowment effect. Lancaster (1966) hypothesized that the properties of a good determine its utility, suggesting that the value an individual places on a good can be attributed to these characteristics. Other experiments on the endowment effect had used common market goods that were known to students, such as candy bars and coffee cups. This experiment, therefore, used a plastic McGill cup and a 400 gm chocolate bar of similar monetary value. Depending on their preferences, half of the subjects were expected to select the cup and the other half were expected to select the candy. Surprisingly, when given a choice, over eighty percent of the students picked the McGill cup (Figure 3.2). Nevertheless, even with a popular item like the McGill cup, giving subjects an endowment of a similarly priced good distorted their choice behaviour from that predicted by current economic theory. Thus, our first hypothesis was confirmed. Subjects who were given the chocolate bar increased the value they assigned to the chocolate bar.

The second hypothesis tested the robustness of the endowment effect. It was expected that changes in key phrases of the instructions would modify the intensity of any observed behaviour. However, the results clearly showed that wording had no influence on the subjects' decisions (Figure 3.3). This suggests that the

endowment effect is induced by something other than ambiguous experimental conditions.

Several alternative theories on decision making have been suggested by researchers in many fields (Plous 1993). Choices are not made in a static world. Rarely do individuals have complete information as economists assume. Simon's bounded rationality (Heap et al. 1992) suggests a way individuals cope with incomplete information. Rather than incurring the cost of gathering and evaluating new information so that all choices would be optimized, a person will use short-cuts that have been learned in previous situations to achieve a second best (or less) outcome. Therefore, individuals will make "satisficing" rather than optimizing decisions. This implies that individuals will make seemingly irrational choices in situations where there is a continuous flow of new information.

Neoclassical models do not allow for preference changes within the time frame of the model. There is an *a priori* assumption that preferences are transitive, i.e., if $x \geq y$ and $y \geq z$, then $x \geq z$. Empirical observations of choice behaviour, however, often appear to violate this axiom.

Kahneman and Tversky's prospect theory (1979) postulates that people do not maximize utility but rather evaluate options as changes from a reference point. They characterize consumer behaviour with a sigmoid value function that is convex for losses and concave for gains. Decisions will be valued differently, depending on whether they are perceived as losses or gains. It has been suggested that the endowment effect is a manifestation of the prospect theory (Kahneman et al. 1990). Once something is included in an individual's endowment, the compensation that would be required to give up the item is higher than the price that would be paid to acquire the item in the first place. The results of our experiment are consistent with prospect theory and not with economic consumer theory.

3.4 CONCLUSIONS

It appears the act of transferring ownership gives a good a new attribute which increases its value to an owner. The implications of such a shift in value are vast when taken in the context of environmental valuation. Assessing the value of commonly owned environmental resources may be distorted by the endowment effect.

The three principal conclusions of our study are:

1. The endowment effect exists and can be elicited by the transfer of ownership;

2. The results support other research that shows losses are valued more than gains;

3. The endowment effect is not easily influenced by instructional wording.

THE EFFECTS OF INFORMATION AND NONMONETARY VALUATION BIASES ON WILLINGNESS-TO-PAY AND ATTRIBUTE SCORES

4.0 INTRODUCTION

Government policies aimed at achieving an optimal allocation of public environmental resources are frequently based on benefit-cost analysis. This analysis generally requires placing a monetary value on the environmental good in question. Unlike market goods, however, demand curves for environmental goods can not be derived by traditional methods. The total economic value of an environmental good can be measured by maximum willingness-to-pay. Pearce and Turner (1990) define total economic value as the sum of actual use value, option value and existence value. Option value is the value assigned by an individual to a good to have it available for use by themselves, future generations and other individuals. Existence value is an intrinsic value, not related to the use or option values.

Economists have developed various tools to measure the value of nonmarket goods. Direct techniques such as hedonic pricing models or travel cost models use a surrogate market to infer value for a particular characteristic of the nonmarket good. Hypothetical markets are used in contingent valuation surveys to elicit a monetary value for a nonmarket good (Smith 1993).

Researchers have identified several types of bias that may contribute to false statements of value on contingent valuation surveys: starting point bias, vehicle bias, information bias, and framing effects (Cummings et al. 1986; Mitchell and Carson 1989). Numerous studies have been conducted to test the reliability and precision of CVM responses (Smith 1993). However, there are no real world values against which the survey results can be compared. Diamond and Hausman (1994) have even suggested that consumers do not have preferences for the nonmarket goods that are being evaluated by contingent valuation surveys. Fischhoff (1991) warned

that if the paradigm used to study value does not match the paradigm used by the individual to assign value, researchers will obtain biased responses.

Experimental economics may provide an approach that can be used to test the precision of hypothetical responses. If consumers do not have stable and well-defined preferences for nonmarket goods, they may be building preferences from a set of basic values in response to elicitation questions. Thus, biases in the survey environment may unduly prejudice the amount individuals state they are willing to pay or willing to accept. Isolating the biases that can influence an individual's perception of value for a environmental resource may lead to the better design of surveys. Empirical evidence can be used to inductively develop a theory of individual choice without well-defined preferences (Harris et al. 1989).

This study examines the effects of two types of bias (1) information bias, and (2) nonmonetary valuation bias, which is a type of framing bias, on the valuation of twelve goods classified as either public or private and as either environmental or nonenvironmental. First, it was hypothesized that if subjects were given information about sustainable development, their subsequent valuation of environmental goods or services would be upwardly biased. This information, however, was not expected to change the amount subjects would be willing to pay for nonenvironmental items.

Secondly, it was proposed that framing questions to elicit an initial nonmonetary value (i.e., personal importance or personal benefit) for a nonmarket (public) good would bias any subsequent monetary valuation of that good. This effect was not expected to be observed for market (private) goods. Moreover, it was hypothesized that the effect of the value bias would persist, influencing how subjects ranked various attributes of nonmarket goods.

Furthermore, it was hypothesized that societal importance attributes would be correlated to WTP for more public goods than private goods, and that private goods would have higher value precision than public goods. Finally, it was hypothesized that

personal importance and personal benefit scores would be positively correlated to WTP for private, but not public goods.

4.1 MATERIALS AND METHODS

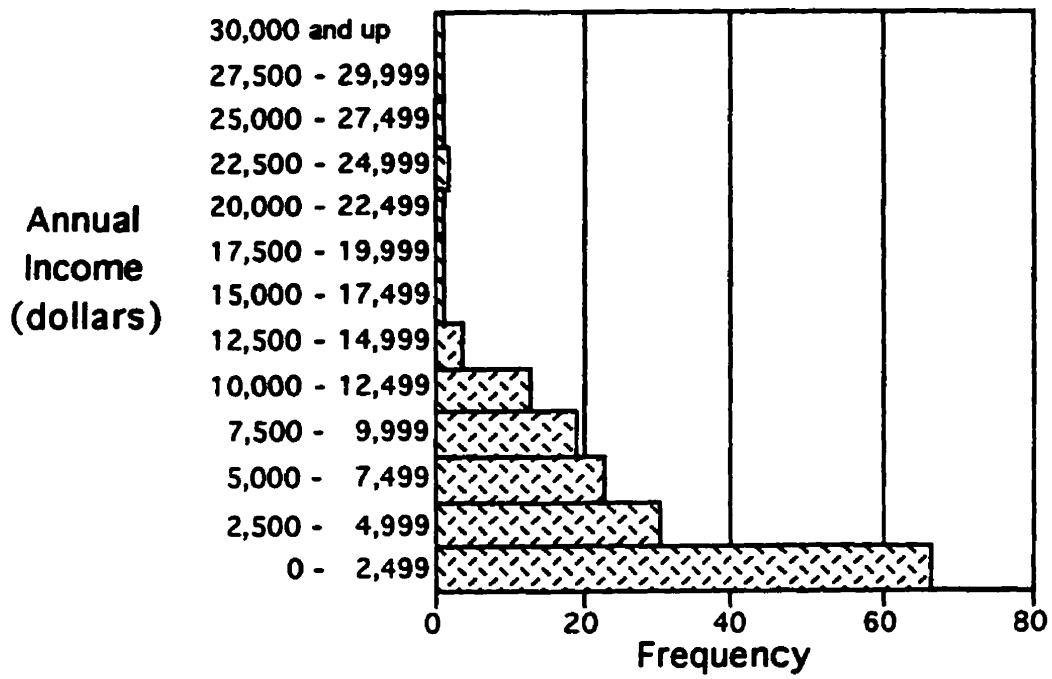
4.1.1 Subjects

All one hundred sixty-seven undergraduate students that participated in the experiment described in Chapter 3 were included in this experiment. In addition, seven additional students were recruited at the McGill University main campus for an unscheduled session on May 18, 1994, and, like the other subjects, paid $10 for their participation. These individuals also signed a consent form in accordance with McGill University's guidelines for nonmedical research involving human subjects.

Most people who participated in the experiment were Canadian citizens (81%). Sixty-four percent (111) of the subjects were female. Ninety-five percent of the students sampled ranged between seventeen and twenty-five years of age with the same age distribution described in Chapter 3. Over two-thirds (117) of the participants resided in the city of Montreal and over seventy percent (125) considered themselves bilingual in French and English. Just over half of the students indicated that they lived with family members (90). The proportion of subjects in each area of study and year enrolled were the same as in Chapter 3. In addition, only thirteen percent of the subjects (23) belonged to an environmental organization.

Thirty percent (53) of the subjects were employed. Thus as expected, the annual income of most individuals was low, with almost forty percent between zero and $2,499. Few subjects had an annual income in excess of $12,500 (Figure 4.1A). In comparison to individual annual income, the distribution of annual household income was higher. Household incomes of about one-fifth of the respondents (37) exceeded $30,000 (the maximum category), most likely representing students living at home (Figure 4.1B).

A) Personal Annual Income (n=164)



B) Annual Household Income (n=150)

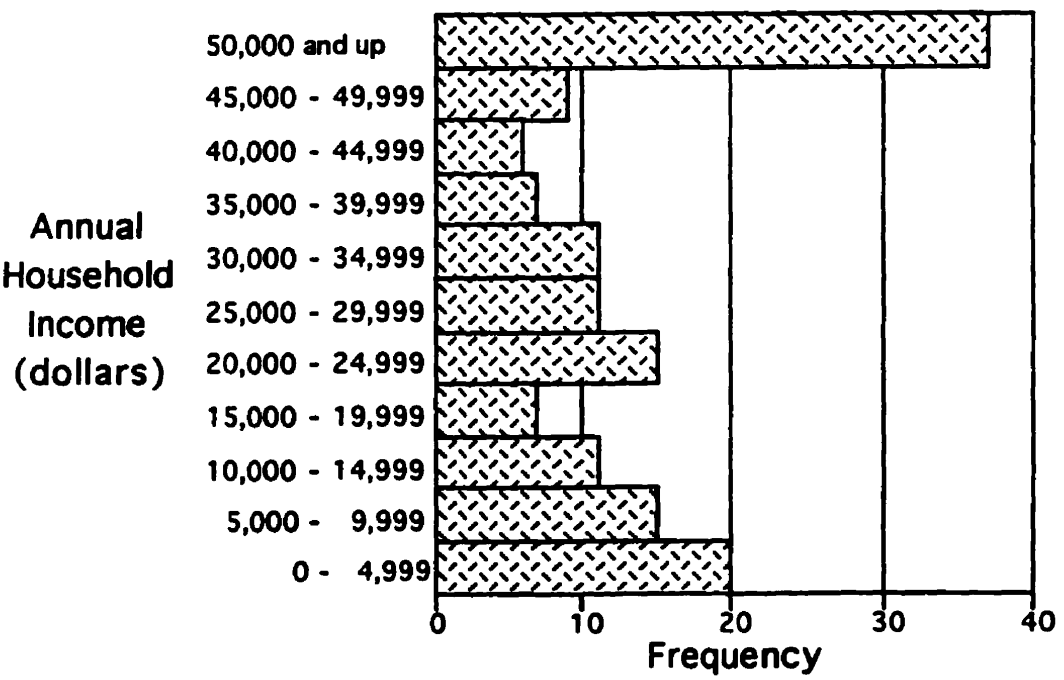


FIGURE 4.1. Annual Income Frequency Distributions of Subjects. n = number of responses to the question.

4.1.2 Schedule and Location

The experiment was conducted over a ten-day period in May 1994 (Table 4.1). Each individual session contained all the of experimental treatments. Times of the sessions were selected to fit with the undergraduate class schedule. All experiments were conducted in the same classroom in the McLennan-Redpath Library complex. Six different versions of the questionnaire were randomly distributed at each session. Long tables were arranged identically with a questionnaire, pencil and instruction sheet for each participant, with an empty place separating each person.

TABLE 4.1. Dates and Times of Experimental Sessions

	16 May Monday	17 May Tuesday	18 May Wednesday	19 May Thursday	25 May Wednesday
09:00	▨	▨			
12:30	▨	▨	▨	▨	▨
14:00			▨		

Individuals waited outside the classroom until the scheduled time of the experimental session. Upon entering the room, subjects were instructed to sit at any available desk with a questionnaire. Subjects were informed that talking was prohibited during the experiment. Once everyone was seated, verbal and written instructions were given. Subjects had the opportunity to ask questions before the experiment started. On average, the experiment lasted one hour, but students were allowed to take as much time as

was necessary to complete the questionnaire. After one hour, any students who had finished the questionnaire exited the classroom and were paid.

4.1.3 Questionnaire

The questionnaire was designed to examine the effect of information and value biases on (1) maximum willingness-to-pay, and (2) the classification of six attributes for each of twelve hypothetical goods. Precautions were taken to control for other biases. All questionnaires were approximately the same length (Appendix D). Extensive use of dummy questions disguised the purpose of the experiment. Five of the nine sections that contained only dummy questions were not analyzed. Questions followed the same order in all versions of the questionnaire. The order of individual questions within a section was determined by a random number generator. To keep the time of the experiment under one hour, the number of goods and attributes were limited to twelve and six, respectively.

4.1.4 Evaluating Hypothetical Goods and Their Attributes

Different categories of goods were expected to respond differently to the biases being tested. The twelve items selected for the experiment can be classified into four subgroups: public nonenvironmental, public environmental, private nonenvironmental or private environmental goods. For this study, goods or services provided by the public sector were designated as public goods. Goods or services that predominately involved an environmental resource were classified as environmental goods. Each question contained a general description of the hypothetical good or service, including information about timing (i.e., day, month, year, etc.) and location, if applicable (Table 4.2).

TABLE 4.2. Item Codes and Descriptions

Public Non-environmental Goods (PuN):

Item Code	Item Description
DENTAL CARE	Yearly Medicare-funded dental examinations (including teeth cleaning) for all individuals.
EDUCATIONAL PROGRAM	A two-year educational program on health risks associated with smoking cigarettes and drinking alcohol.
HOMELESS SHELTERS	A three-year program of shelters for homeless youth in urban centers throughout Canada.

Public Environmental Goods (PuE):

Item Code	Item Description
RIVER CLEAN-UP	A substantial improvement in the water quality of the St. Lawrence River over the next five years.
B.C. FORESTS	A permanent program for the conservation of old-growth forests in British Columbia.
MONTREAL GREENSPACE	A permanent program for the protection of forested greenspace on Mount Royal in Montreal.

Private Non-environmental Goods (PrN):

Item Code	Item Description
MCGILL TUITION	A three-credit course at McGill University.
PORTABLE WALKMAN	A Walkman portable cassette player.
MAPLE SYRUP	A 4-litre container of #1 clear Quebec maple syrup.

TABLE 4.2. continued

Private Environmental Goods (PrE):

Item Code	Item Description
MONTREAL BIODOME	A $35.00 pass for unlimited entries into the Biodôme de Montréal for one year.
CANOE TRIP	A three-day canoe trip led by Algonquin guides on the Harricana River in the Abitibi region of northern Quebec.
WHALE-WATCHING	A half-day cruise from Tadoussac, Quebec to see the beluga whales in the St. Lawrence River.

Subjects responded to open-ended questions about the maximum amount they would be willing to pay for each item using their current income. However, during the pre-test phase of the study, students who were not employed said they used fictitious incomes to answer these questions. The final instructions, therefore, stipulated that if subjects had no income, they could use a hypothetical income to determine their willingness-to-pay. Subjects disclosed the annual income they used to answer the WTP questions.

It was believed that the monetary value of a good assigned by a subject could be linked to that subject's evaluation of specific attributes of the good. Six attributes were chosen to test this hypothesis. Subjects ranked the six attributes for twelve goods on a scale from 1 to 7 (Table 4.3).

TABLE 4.3. Attribute Questions

1) How important to Canadian society is **the good**, compared with not having it?								
unimportant	1	2	3	4	5	6	7	*very important*
2) How common / rare is **the good**?								
rare	1	2	3	4	5	6	7	*common*
3) Once **the good** has been acquired, how long do most of its benefits occur?								
immediately	1	2	3	4	5	6	7	*forever*
4) How important to the people of Quebec is **the good**, compared with not having it?								
unimportant	1	2	3	4	5	6	7	*very important*
5) How precise is your sense of the value to you of **the good**?								
imprecise	1	2	3	4	5	6	7	*very precise*
6) How beneficial/harmful to the natural environment is **the good**?								
beneficial	1	2	3	4	5	6	7	*harmful*

In the questionnaire, the actual name of the good replaced the phrase, "**the good**".

4.1.5 Bias Treatments

To test the hypothesis that environmental information would bias valuation of environmental goods, half of the questionnaires contained a short excerpt from an Environment Canada booklet on sustainable development. The other half of the questionnaires contained a similar length newspaper article on the sinking of the Titanic (Appendix E).

Valuation of goods and services can be in monetary or nonmonetary terms. It has been suggested that eliciting a nonmonetary value for a good will bias any subsequent monetary valuation of the same good (Gregory et al. 1992). To test this hypothesis, three different questionnaire formats were used:

(1) Questions only elicited monetary values (i.e., control);

(2) Questions elicited an importance ranking for all goods before the monetary value (i.e., importance bias);

(3) Questions elicited a benefit ranking for all goods before the monetary value (i.e., benefit bias).

Discrete questions with responses from zero to ten were used to obtain the nonmonetary importance or benefit values. A score of zero indicated that subjects thought the item was unimportant or of no benefit to them, whereas a score of ten indicated that subjects thought the item was very important or of high benefit to them. All questions had identical wording except for the description of the good or service.

Thus, there were six different treatment combinations (Table 4.4). The information bias was coded 1 or 2 depending on whether subjects received the sustainable development document or the article on the Titanic, respectively. The value bias was coded 1, 2 or 3 corresponding to the control, importance or benefit biases, respectively.

TABLE 4.4. Questionnaire Coding

Version Number	Information Bias Treatment (*Titanic or Sustainable Development*)	Value Bias Treatment (*Importance, Benefit, or No Bias*)
1	1	1
2	1	2
3	1	3
4	2	1
5	2	2
6	2	3

4.1.6 Data Analysis

4.1.6.1 Data Transformations and Removal of Outliers

4.1.6.1.1 WTP Data

As observed in other willingness-to-pay studies, a minority of subjects gave unrealistic answers (Mitchell and Carson 1989). In this study, maximum willingness-to-pay ranged from $0 to $300,000,000 for public goods, and $0 to $6,000 for private goods. Outliers were discarded from the data before beginning the analysis[1].

An analysis of variance assumes that data has equal variance. Therefore, a Bartlett test of homogeneity of variances was used to determine if it was necessary to transform the WTP data before conducting the analysis of variance (Snedecor and Cochran 1980).

[1] Outliers were dropped in pairs. A maximum and minimum range was established that was three standard deviations from the mean. Any value that exceeded the maximum or minimum was dropped along with the corresponding opposite extreme value. Thus, if a high value of $300,000,000 was dropped, the lowest value in that data set was also dropped.

The results of the Bartlett test showed that WTP for all but two of the goods had to be transformed to achieve homogenous variance (Table 4.5). The natural log transformation was tried first. If this

TABLE 4.5. WTP Data Transformations

Question Code:	*Transformation:*
DENTAL CARE	$\sqrt{X}$
EDUCATIONAL PROGRAM	$\ln(x+1)$
HOMELESS SHELTER	$\ln(x)$
RIVER CLEAN-UP	$\ln(x)$
B.C. FORESTS	$\ln(x)$
MONTREAL GREENSPACE	$\ln(x)$
MCGILL TUITION	$\sqrt{X}$
PORTABLE WALKMAN	none
WHALE-WATCHING	$\ln(x+1)$
MONTREAL BIODOME	none
CANOE TRIP	$\ln(x+1)$
MAPLE SYRUP	$\ln(x+1)$

transformation did not result in homogenous variance, square root and exponential transformations were subsequently tried until the Bartlett test showed that the variance was equal.

4.1.6.1.2 Attribute Data

The variances of the attribute data were also checked with a Bartlett test (Snedecor and Cochran 1980). In contrast to the WTP data, all questions except the environmental impact question for four goods had homogenous variance. Before further analysis was conducted, the nonhomogenous attribute data were transformed by:

(1) $\ln(x)$ for B.C. forests and Montreal greenspace;

(2) $\sqrt{x}$ for maple syrup;

(3) $1/x^2$ for the river clean-up.

4.1.6.2 Analyses of Variance (ANOVA)

Treatment effects were analyzed for each individual good using an unbalanced, 2-by-3 factorial design with interaction. The treatment factors were (1) two levels of the information bias (i.e., sustainable development or Titanic article) and (2) three treatment levels of value bias (i.e., control, importance and benefit bias). Each individual was considered to be an experimental unit. Significance for interactions was restricted to an alpha value of 1% or less. Analyses showed no significant effects of the experimental sessions or interactions between main effects.

4.1.6.3 Comparisons of Means

For significant ANOVA treatment effects, a Tukey's studentized range test was performed. Significance was restricted to an alpha value of 5% or less.

4.1.6.4 Correlations

Since parametric correlations can not be accurately calculated for nonnormal data, the Shapiro-Wilk test was used to test if data

were normally distributed (Conover 1980). Most WTP and attribute data were not normally distributed. Consequently, only nonparametric correlations were calculated. For individual goods, the Kendall tau-b (Conover 1980) was used to test if there was a significant concordance or disconcordance between (1) WTP and the personal importance rank, (2) WTP and the personal benefit rank, and (3) willingness-to-pay and the six attributes. The Kendall tau-b is a ranked correlation coefficient using paired observations, ranging from -1 to 1. Values close to -1 or 1 indicate high correlation.

4.1.6.5 Software

Data was analyzed with the SAS® version 6 (1989) statistical software package for an IBM VM1 mainframe. The GLM procedure was used for the analyses of variance and Tukey's tests (SAS Institute Inc. 1993).

4.2 RESULTS

4.2.1 Bias Effects on Maximum Willingness-To-Pay

The analyses of variance of the effects of information and value biases on maximum willingness-to-pay were significant for six of the twelve hypothetical goods included in this experiment (Table 4.6; see Appendix G for all nonsignificant results). Since no significant interactions between the value and information biases were found for any individual item, information bias and value bias effects are presented separately as main effects.

The value bias altered the maximum amount subjects specified they were willing to pay for six goods (Table 4.6): (1) four public and two private goods, or (2) four nonenvironmental and two environmental goods. For the public goods, dental care, educational health program, homeless shelters, and river clean-up, subjects asked about the personal benefit they received assigned dollar

TABLE 4.6. Significant Value and Information Bias Effects on WTP by Good

	INDEPENDENT EFFECTS					
	Value Bias (V) 2 d.f.		Information Bias (I) 1 d.f.		I x V Interaction 2 d.f.	
	F Value	Pr > F	F Value	Pr > F	F Value	Pr > F
Dental Care (PuN)	7.86	* 0.0006	0.07	(n.s.) 0.7852	1.52	(n.s.) 0.2222
Educational Program (PuN)	3.36	* 0.0378	9.77	* 0.0022	0.56	(n.s.) 0.5718
Homeless Shelters (PuN)	8.51	* 0.0003	1.03	(n.s.) 0.3126	0.40	(n.s.) 0.6739
River Clean-up (PuE)	5.22	* 0.0066	7.18	* 0.0084	1.97	(n.s.) 0.1437
Portable Walkman (PrN)	5.74	* 0.0040	0.01	(n.s.) 0.9357	1.00	(n.s.) 0.3716
Montreal Biodome (PrE)	4.13	* 0.0179	0.12	(n.s.) 0.7301	0.19	(n.s.) 0.8248

* significant at the 5% level; (n.s.) not significant at the 5% level.
PuN = Public Non-environmental Good; PuE = Public Non-environmental Good;
PrN = Private Non-environmental Good; PrE = Private Environmental Good.

amounts significantly lower than subjects in the control group (Figure 4.2A). The only private good similarly affected by the benefit bias was the Montreal Biodome (Figure 4.2B). For all other goods, the benefit-biased group and the control group assigned similar WTP (Figure 4.2).

In contrast, importance appeared to be a weaker bias than benefit. Subjects who were asked about a good's importance to them specified a lower maximum WTP than subjects in the control group for only one public good, dental care (Figure 4.2A), and only two private goods, the portable walkman and the Montreal Biodome pass (Figure 4.2B). Moreover, for all other goods, subjects in the importance-biased group assigned a statistically equivalent monetary value to that of subjects in the control group (Figure 4.2)

The information bias, i.e., reading about sustainable development, modified the maximum amount subjects specified they were willing to pay for only two goods: (1) the educational program about health risks of cigarettes and alcohol, and (2) the St. Lawrence River clean-up (Table 4.6). Although both of these items are public goods, only the river clean-up was classified as an environmental good. Comparison of treatment means showed that information about sustainable development increased the amount subjects stated that they were willing-to-pay for these two goods (Figure 4.3A). For all private goods, subjects in the control group and the information treatment group assigned statistically similar WTP (Figure 4.3B).

4.2.2 Correlation of Attribute Scores to Willingness-To-Pay

It was hypothesized that for the same type of good, i.e., public, private, environmental and nonenvironmental, similar attribute scores would be correlated to WTP. In addition, attributes that were significantly correlated to willingness-to-pay were expected to be sensitive to the same biases that affected WTP. However, only half of the goods surveyed had one or more significant nonparametric

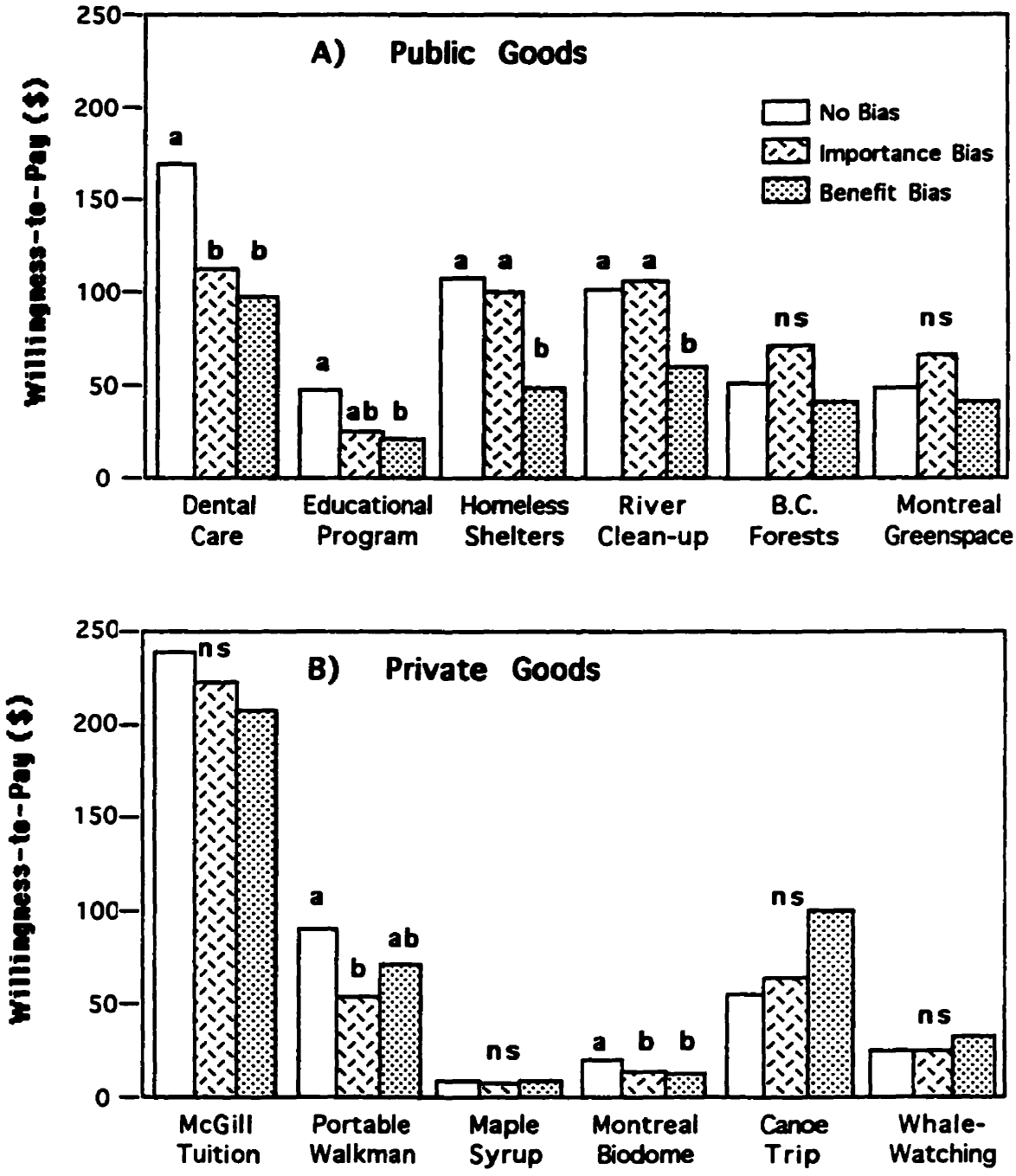


FIGURE 4.2. Differences In Stated Willingness-To-Pay By Value Bias Treatment For Six Public And Six Private Goods. For a single good, means having different letters are significantly different at $p < 0.05$. No comparisons were made between individual goods. ns, not significant. Dental care, McGill tuition, portable walkman and Montreal Biodome are arithmetic means; all others are geometric means.

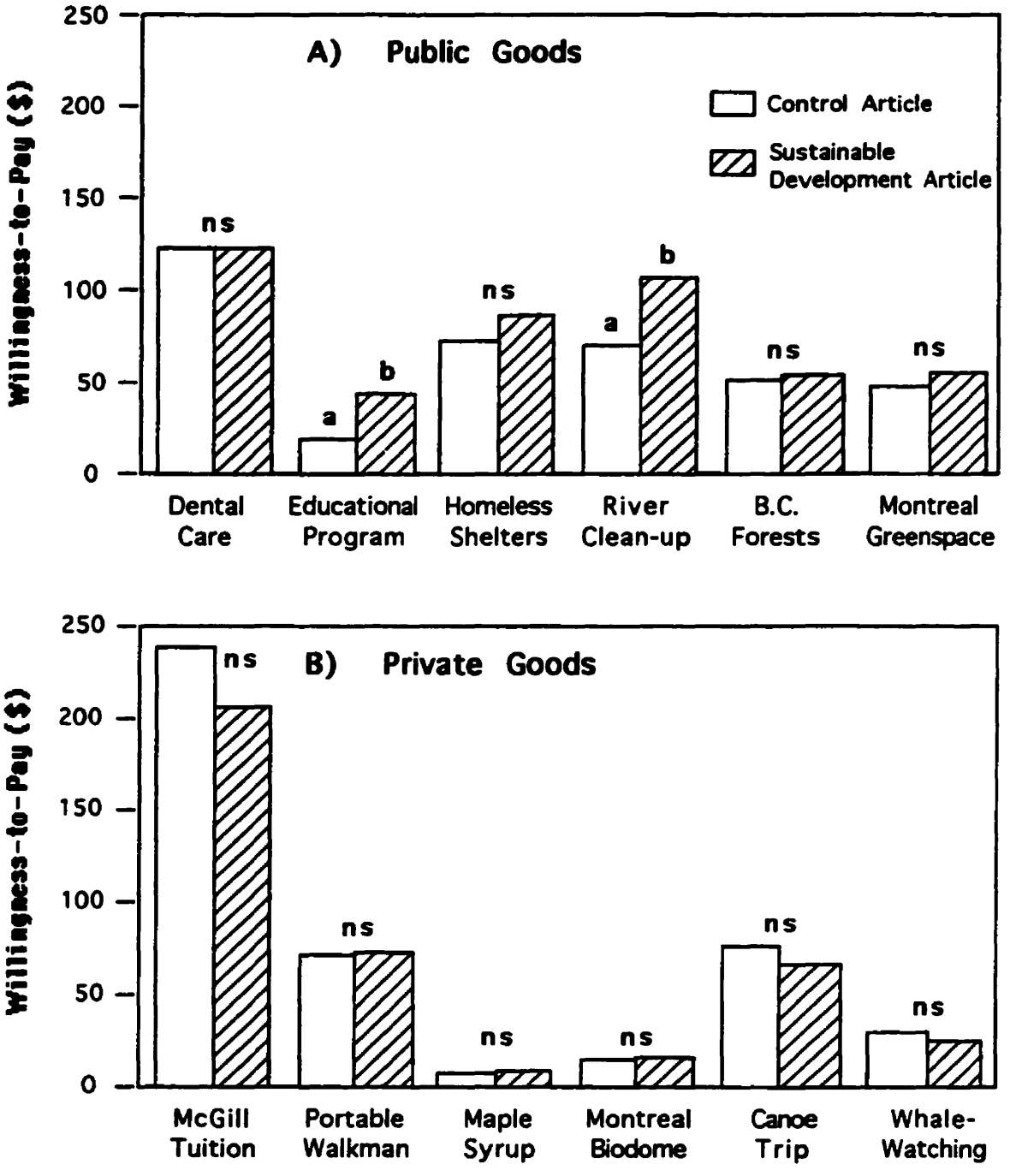


FIGURE 4.3. Differences In Stated Willingness-To-Pay By Reading Treatment (Information Bias) For Six Public And Six Private Goods. For a single good, means having different letters are significantly different at $p < 0.05$. No comparisons were made between individual goods. ns, not significant. Dental care, McGill tuition, portable walkman and Montreal Biodome are arithmetic means; all others are geometric means.

correlations between attribute scores and WTP (Table 4.7). Scarcity was not correlated to WTP for any good.

The correlations can be examined in terms of a particular good or in terms of a particular attribute. Duration of benefits was the attribute correlated to WTP for more goods than any other attribute, i.e., four goods. In contrast, value precision, importance to Quebec and environmental impact were correlated to WTP for the least number of goods, i.e., two goods. Canadian societal importance was correlated to WTP for three goods.

In terms of category of good, the six goods with significant correlations of attribute scores to WTP can be classified as (1) three public and three private goods or (2) three environmental and three nonenvironmental goods. Moreover, none of the goods with significant correlations had more than four attributes correlated to WTP (Table 4.7).

It was hypothesized that the two societal importance attributes, importance to Quebec and Canadian societal importance, would be significantly correlated to WTP more often for public goods than private goods. While not as strong an effect as expected, importance to Quebec was correlated to WTP for two public goods, the educational program and the river clean-up, and to no private goods (Table 4.7). Canadian societal importance was also correlated to WTP for two public goods, the educational program and B.C. forests. Furthermore, this attribute was also correlated to WTP for one private environmental good, the canoe trip. One interpretation of this result is that while the canoe trip was a private good, it traverses a public waterway (Table 4.7).

Overall, the signs of most correlations indicated that as the attribute score increased, WTP increased. The one exception, environmental impact, was negatively correlated to WTP, which was consistent with the way the question was worded.

TABLE 4.7. Significant Nonparametric Correlations Between Attribute Score and Willingness-to-Pay by Good

	CANADIAN SOCIETAL IMPORTANCE		VALUE PRECISION		DURATION OF BENEFITS	
	tau b	(P)	tau b	(P)	tau b	(P)
Educational Program (PuN)	0.32	* 0.0001	0.12	(n.s.) 0.0767	0.26	* 0.0001
River Clean-up (PuE)	0.11	(n.s.) 0.1075	0.23	* 0.0006	0.17	* 0.0117
B.C. Forests (PuE)	0.20	* 0.0027	0.19	* 0.0039	0.13	(n.s.) 0.0670
McGill Tuition (PrN)	0.11	(n.s.) 0.0712	0.03	(n.s.) 0.6003	0.17	* 0.0044
Portable Walkman (PrN)	0.08	(n.s.) 0.1698	-0.12	(n.s.) 0.0549	0.16	* 0.0062
Canoe Trip (PrE)	0.18	* 0.0028	0.11	(n.s.) 0.0591	0.14	(n.s.) 0.0203

	IMPORTANCE TO QUEBEC		ENVIRON. IMPACT	
	tau b	(P)	tau b	(P)
Educational Program (PuN)	0.26	* 0.0001	-0.24	* 0.0004
River Clean-up (PuE)	0.18	* 0.0098	-0.15	(n.s.) 0.0362
B.C. Forests (PuE)	0.08	(n.s.) 0.2108	-0.12	(n.s.) 0.0932
McGill Tuition (PrN)	0.01	(n.s.) 0.8160	-0.01	(n.s.) 0.8227
Portable Walkman (PrN)	0.06	(n.s.) 0.2885	-0.23	* 0.0002
Canoe Trip (PrE)	0.10	(n.s.) 0.1052	-0.05	(n.s.) 0.4018

* significant at the 1% level; (n.s.) not significant at the 1% level.
PuN = Public Non-environmental Good; PuE = Public Non-environmental Good;
PrN = Private Non-environmental Good; PrE = Private Environmental Good.

4.2.3 Bias Effects on Attribute Scores

The analyses of variance of attribute scores showed that only eight of the 72 individual attributes were affected by the information and value biases (see Appendix G for nonsignificant results). Since no significant interactions between the bias treatments were found, individual information and value bias effects for significant effects are presented as main effects (Table 4.8). The environmental impact scores of all twelve goods used in the experiment were not affected by the bias treatments.

Value bias, i.e., asking about the personal importance or benefit of the good, significantly affected the score of one attribute for three nonenvironmental goods: (1) duration of benefits for dental care, (2) importance to Quebec for the educational program about the health risks of cigarettes and alcohol and (3) value precision for McGill tuition (Table 4.8). Unlike the effect of the value bias on WTP, subjects in the benefit-biased group scored most attributes similarly to subjects in the control group (Figure 4.4). The importance-biased attribute scores of (1) importance to Quebec for the educational program, and (2) duration of benefits for dental care, however, were significantly lower than the scores assigned by the control group (Figures 4.4A and 4.4B). The benefit-biased scores assigned to value precision for the McGill tuition were significantly lower than importance-biased scores (Figure 4.4C).

The information bias, i.e., reading about sustainable development, significantly modified five attribute scores (Table 4.8). The sustainable development excerpt used in this experiment specifically mentioned the problem of pollution in the St. Lawrence River as one of the challenges facing Canadians. It is not surprising, therefore, that scores for three attributes of the river clean-up, i.e., (1) Canadian societal importance, (2) importance to Quebec, and (3) value precision, were biased upward by the sustainable development reading (Figure 4.5). Furthermore, information about sustainable development appeared to increase (1) the scarcity score for the

TABLE 4.8. Significant Value and Information Bias Effects on Attribute Scores by Good

	INDEPENDENT EFFECTS					
	Value Bias (V) 2 d.f.		Information Bias (I) 1 d.f.		I x V Interaction 2 d.f.	
	F Value	Pr > F	F Value	Pr > F	F Value	Pr > F
Dental Care (PuN):		*		(n.s.)		(n.s.)
• Duration of Benefits	3.33	0.0385	3.54	0.0621	1.12	0.3303
Educ. Program (PuN):		*		(n.s.)		(n.s.)
• Importance to Quebec	3.03	0.0518	0.64	0.4266	1.73	0.1821
River Clean-up (PuE):		(n.s.)		*		(n.s.)
• Canadian Societal Impt	0.07	0.9360	10.75	0.0013	0.21	0.8133
		(n.s.)		*		(n.s.)
• Importance to Quebec	0.62	0.5419	5.31	0.0228	0.02	0.9823
		(n.s.)		*		(n.s.)
• Value Precision	0.01	0.9896	4.05	0.0463	1.45	0.2378
McGill Tuition (PrN):		*		(n.s.)		(n.s.)
• Value Precision	3.58	0.0302	0.00	0.9726	2.85	0.0612
Portable Walkman (PrN):		(n.s.)		*		(n.s.)
• Scarcity	1.20	0.3053	6.53	0.0116	0.31	0.7370
Maple Syrup (PrN):		(n.s.)		*		(n.s.)
• Importance to Quebec	1.98	0.1415	3.86	0.0513	1.40	0.2494

* significant at the 5% level; (n.s.) not significant at the 5% level.
PuN = Public Non-environmental Good; PuE = Public Non-environmental Good; PrN = Private Non-environmental Good.

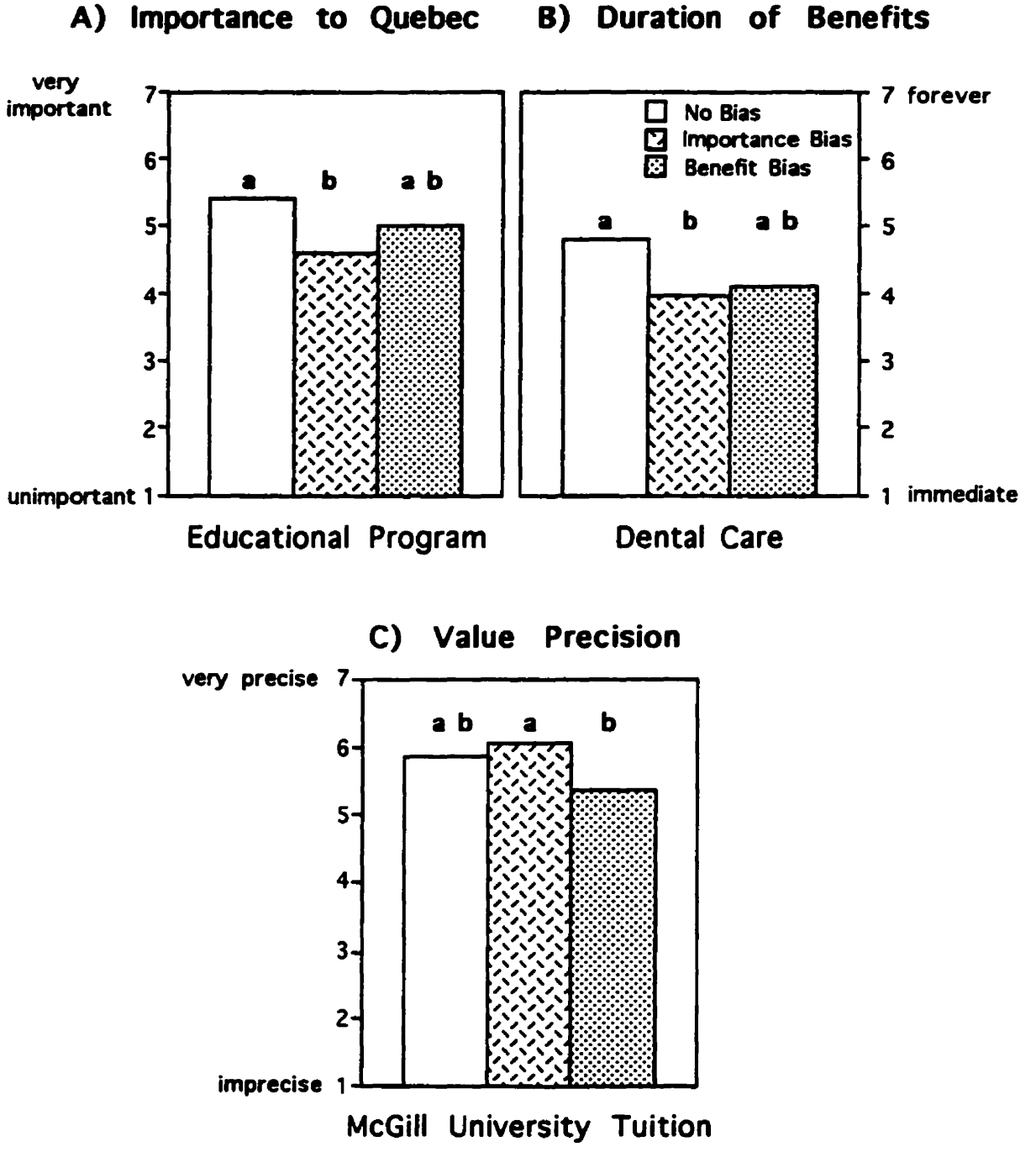


FIGURE 4.4. Significant Differences In Arithmetic Mean Attribute Scores By Value Bias Treatment For Three Goods. For a single attribute, means having different letters are significantly different at $p < 0.05$. No comparisons were made between goods or attributes.

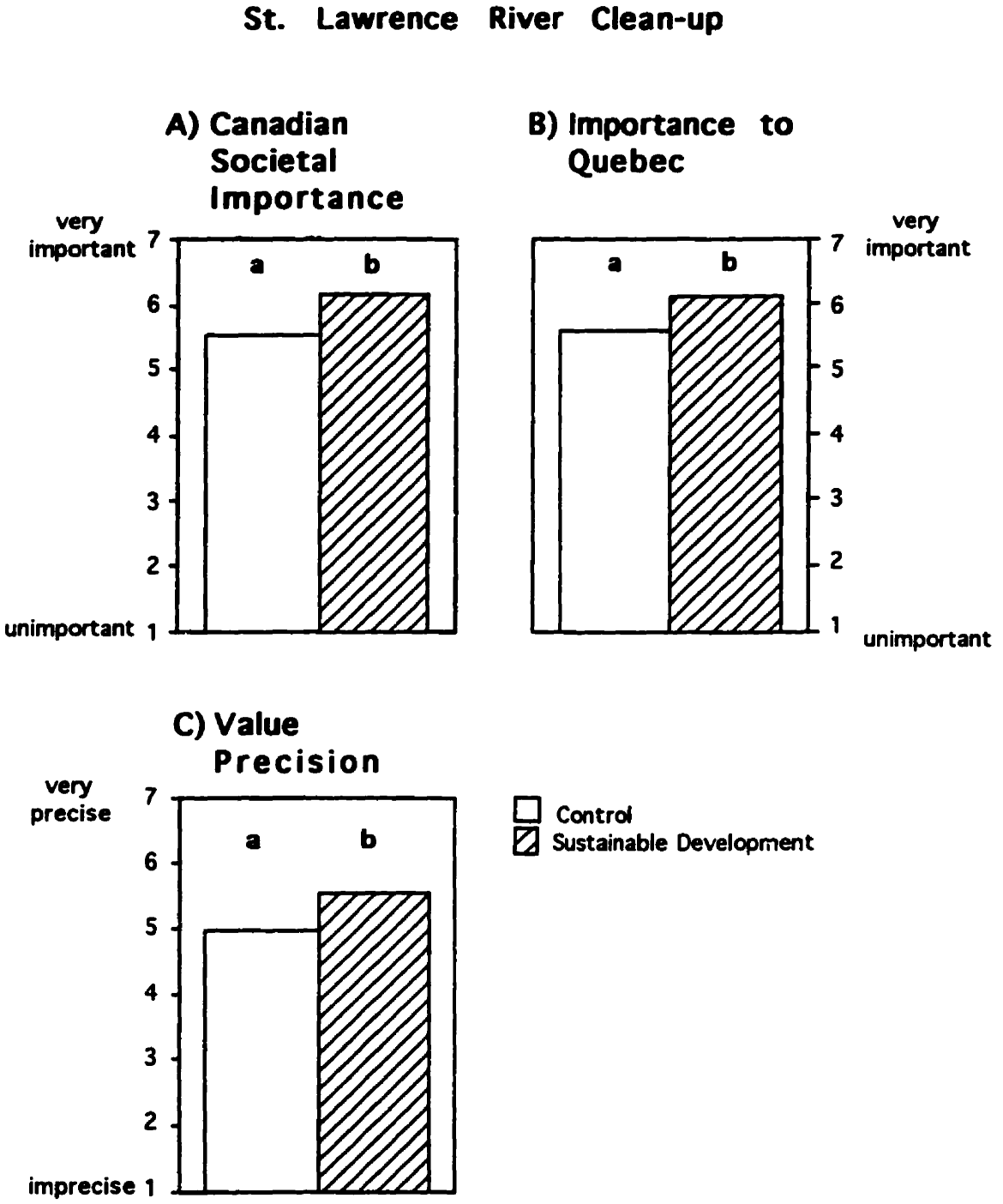


FIGURE 4.5. Significant Differences In Arithmetic Mean Attribute Scores By Information Bias Treatment For The St. Lawrence River Clean-up. For a single attribute means having different letters are significantly different at $p < 0.05$. No comparisons were made between individual attributes.

portable walkman, and (2) the importance to Quebec score for maple syrup over the scores assigned by the control group (Figure 4.6).

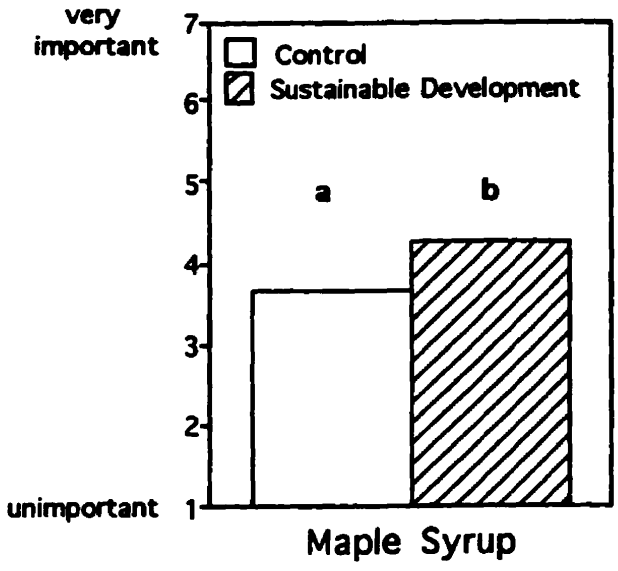
4.2.4 Mean Attribute Scores

Mean scores for each attribute were ranked to determine if scores for public, private, environmental and nonenvironmental goods would cluster together. When there was a significant bias effect, mean scores were reported for each treatment group. Attribute scores ranged from one to seven (Table 4.3). A numeric score of four corresponded to the center of the range and was considered a neutral response.

For the environmental impact attribute, all items except the portable walkman had mean scores below four, indicating that subjects judged most goods to have a beneficial environmental impact. Moreover, the three public environmental goods were clustered together with the three lowest values, i.e., the most beneficial environmental impact (Table 4.9A). In contrast, the three private environmental goods were ranked in the middle, below two public nonenvironmental goods, i.e., the educational program about health risks of cigarettes and alcohol, and homeless shelters.

Seventy-five percent of the mean scores for scarcity were below the mid-point score of four, implying that subjects considered most goods described in the experiment to be relatively rare (Table 4.9A). The goods with mean scores above four were maple syrup, McGill tuition and the portable walkman. The Montreal Biodome pass and the canoe trip, both private environmental goods, were ranked as the two rarest goods, even though these are goods currently available in the marketplace, unlike some of the hypothetical public goods included in this study. Information about sustainable development appeared to increase the mean score for the portable walkman, but did not change its relative rank in comparison to other goods.

A) Importance to Quebec



B) Scarcity

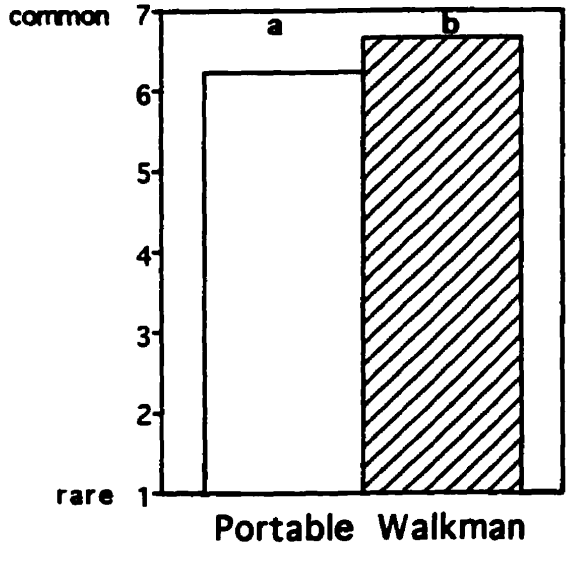


FIGURE 4.6. Significant Differences In Arithmetic Mean Attribute Scores By Information Bias Treatment For Two Goods. For a single attribute, means having different letters are significantly different at $p < 0.05$. No comparisons were made between attributes or goods.

TABLE 4.9A. Ranked Mean Attribute Scores by Good

Rank	ENVIRONMENTAL IMPACT		SCARCITY	
	1= beneficial to 7 = harmful	Mean Score	*1 = rare to 7 = common*	Mean Score
1.	River Clean-up (PuE)	1.2	Canoe Trip (PrE)	2.8
2.	B.C. Forests (PuE)	1.3	Montreal Biodome (PrE)	2.9
3.	Montreal Greenspace (PuE)	1.5	River Clean-up (PuE)	2.9
4.	Educational Program (PuN)	2.0	Homeless Shelters (PuN)	3.2
5.	Homeless Shelters (PuN)	2.7	Educational Program (PuN)	3.3
6.	Montreal Biodome (PrE)	2.9	Dental Care (PuN)	3.3
7.	Canoe Trip (PrE)	2.9	Whale-Watching (PrE)	3.4
8.	McGill Tuition (PrN)	3.0	B.C. Forests (PuE)	3.5
9.	Whale-Watching (PrE)	3.5	Montreal Greenspace (PuE)	3.7
10.	Dental Care (PuN)	3.6	Maple Syrup (PrN)	5.0
11.	Maple Syrup (PrN)	3.9	McGill Tuition (PrN)	6.0
12.	Portable Walkman (PrN)	4.7	Portable Walkman (PrN) *(Info-Control)*	6.2
13.			Portable Walkman (PrN) *(Info-Biased)*	6.6

PuN = Public Non-environmental Good; PuE = Public Non-environmental Good; PrN = Private Non-environmental Good; PrE = Private Environmental Good.

In general, public goods were ranked higher than private goods in terms of Canadian societal importance (Table 4.9B). All private goods except McGill tuition had mean scores below four, i.e., rated by subjects as relatively unimportant to Canadian society. Environmental goods were not ranked more important than nonenvironmental goods. After reading about sustainable development, subjects ranked clean-up of the St. Lawrence River of higher societal importance to Canada than any other good (Table 4.9B), moving it from the sixth to the top ranked position.

Similarly, public goods tended to be ranked higher than private goods in terms of importance to Quebec (Table 4.9B). Moreover, biases affected this attribute score for more goods than any other attribute. Biases changed the ranking of some goods. Information-biased scores were higher for maple syrup and the St. Lawrence River clean-up, pushing their rank to the top position for private and public goods, respectively. The value bias decreased this attribute score for the educational program about health risks of cigarettes and alcohol, dropping the importance-biased score to the next to lower rank for the public goods, although still ranked higher than most private goods.

Of particular interest are differences in rank for local public programs versus public programs situated in the rest of Canada. On the basis of Canadian societal importance, the protection of B. C. forests ranked second whereas the protection of Montreal greenspace was the lowest ranked public good. The unbiased score for the St. Lawrence River clean-up, a program that would directly benefit Quebec, was ranked below B.C. forests and all public nonenvironmental goods. In contrast, protection of Montreal greenspace and the St. Lawrence River clean-up were ranked high in importance to Quebec, whereas the protection of B.C. forests was the lowest ranked public good in terms of importance to Quebec (Table 4.9B).

In comparison to public goods, it was hypothesized that private goods would have a higher value precision since they are available in the marketplace. Although McGill tuition and the

TABLE 4.9B. Ranked Mean Attribute Scores by Good

Rank	CANADIAN SOCIETAL IMPORTANCE		IMPORTANCE TO QUEBEC	
	7 = very important to 1= unimportant	Mean Score	*7 = very important to 1= unimportant*	Mean Score
1.	River Clean-up (PuE) *(Information-Biased)*	6.2	River Clean-up (PuE) *(Information-Biased)*	6.1
2.	B.C. Forests (PuE)	5.6	River Clean-up (PuE) *(Information-Control)*	5.6
3.	Educational Program (PuN)	5.6	Educational Program (PuN) *(Value-Control)*	5.4
4.	Dental Care (PuN)	5.6	Montreal Greenspace (PuE)	5.3
5.	Homeless Shelters (PuN)	5.5	Dental Care (PuN)	5.2
6.	River Clean-up (PuE) *(Information-Control)*	5.5	Educational Program (PuN) *(Benefit-Biased)*	5.0
7.	McGill Tuition (PrN)	4.2	Homeless Shelters (PuN)	5.0
8.	Montreal Greenspace (PuE)	4.1	Educational Program (PuN) *(Impt-Biased)*	4.6
9.	Maple Syrup (PrN)	3.3	Maple Syrup (PrN) *(Information-Biased)*	4.3
10.	Canoe Trip (PrE)	3.2	McGill Tuition (PrN)	4.2
11.	Whale-Watching (PrE)	3.0	B.C. Forests (PuE)	3.8
12.	Portable Walkman (PrN)	2.6	Maple Syrup (PrN) *(Information-Control)*	3.7
13.	Montreal Biodome (PrE)	2.1	Whale-Watching (PrE)	3.4
14.			Canoe Trip (PrE)	3.3
15.			Portable Walkman (PrN)	3.0
16.			Montreal Biodome (PrE)	2.3

PuN = Public Non-environmental Good; PuE = Public Non-environmental Good;
PrN = Private Non-environmental Good; PrE = Private Environmental Good.

portable walkman have the highest mean scores for value precision, the other four private goods were the lowest ranked goods for this attribute (Table 4.9C). St. Lawrence River clean-up was the highest ranked environmental good and the highest ranked public good for value precision. Sustainable development information improved value precision for river clean-up, but did not change its rank relative to the other public and environmental goods. Even though the value bias was associated with a small decrease in the mean score for the value precision of McGill tuition, this attribute was still ranked higher than any public good and all private goods except the portable walkman.

Five public goods and five private goods were the highest and lowest ranked goods for duration of benefits, respectively (Table 4.9C). For the public goods, the rank corresponded to the time frame specified in the description of the good, i.e., permanent, five years, etc. Tuition was the highest ranked private good and maple syrup, a consumable item, was the lowest ranked private good for this attribute. Although the Montreal Biodome pass was valid for one year, subjects ranked the duration of benefits shorter for this good than the half-day whale-watching trip or the weekend canoe trip. Furthermore, the only good whose duration of benefits score was affected by a bias treatment was dental care. The importance and benefit bias decreased the mean score for duration of benefits to a level similar to the weekend canoe trip (Table 4.9C).

4.2.5 Correlation of Importance or Benefit Scores to Willingness-To-Pay (WTP)

Goods selected for this experiment were classified into four categories: (1) private, (2) public, (3) environmental, or (4) nonenvironmental. It was hypothesized that personal importance or personal benefit would be positively correlated to WTP for private goods, but not public goods. Nonparametric rank correlations of personal importance scores with willingness-to-pay showed significant correlations for five of the six private goods and only one of the six public goods (Table 4.10). Similarly, personal benefit

TABLE 4.9C. Ranked Mean Attribute Scores by Good

Rank	VALUE PRECISION		DURATION OF BENEFITS	
	7 = very precise to 1= imprecise	Mean Score	*7 = forever to 1= immediately*	Mean Score
1.	McGill Tuition (PrN) *(Importance-Biased)*	6.0	B.C. Forests (PuE)	6.0
2.	McGill Tuition (PrN) *(Value-Control)*	5.9	Montreal Greenspace (PuE)	5.7
3.	Portable Walkman (PrN)	5.7	River Clean-up (PuE)	5.4
4.	River Clean-up (PuE) *(Information-Biased)*	5.5	Educational Program (PuN)	5.3
5.	McGill Tuition (PrN) *(Benefit-Biased)*	5.3	McGill Tuition (PrN)	5.1
6.	River Clean-up (PuE) *(Information-Control)*	5.0	Dental Care (PuN) *(Value-Control)*	4.8
7.	Educational Program (PuN)	5.0	Homeless Shelters (PuN)	4.6
8.	Montreal Greenspace (PuE)	4.9	Dental Care (PuN) *(Benefit-Biased)*	4.1
9.	Dental Care (PuN)	4.9	Dental Care (PuN) *(Importance-Biased)*	4.0
10.	B.C. Forests (PuE)	4.8	Canoe Trip (PrE)	3.9
11.	Homeless Shelters (PuN)	4.8	Whale-Watching (PrE)	3.7
12.	Maple Syrup (PrN)	4.4	Portable Walkman (PrN)	3.2
13.	Canoe Trip (PrE)	4.3	Montreal Biodome (PrE)	3.1
14.	Whale-Watching (PrE)	4.2	Maple Syrup (PrN)	2.0
15.	Montreal Biodome (PrE)	4.1		

PuN = Public Non-environmental Good; PuE = Public Non-environmental Good;
PrN = Private Non-environmental Good; PrE = Private Environmental Good.

and willingness-to-pay were significantly correlated for three private goods and only one public good (Table 4.10). All of the significant Kendall tau-b coefficients were positive, indicating that higher personal importance or personal benefit scores were associated with higher maximum WTP. Furthermore, there were no discernible differences in the correlations of WTP with personal importance and personal benefit between environmental and nonenvironmental goods (Table 4.10).

TABLE 4.10. Significant Nonparametric Correlations Between Importance or Benefit Score and Willingness-to-Pay by Good

	Importance		Benefit	
	Kendall tau b Coefficent	(P)	Kendall tau b Coefficent	(P)
Dental Care (PuN)	0.36	* 0.0018	0.13	(n.s.) 0.1998
River Clean-up (PuE)	0.18	(n.s.) 0.1215	0.33	* 0.0030
Portable Walkman (PrN)	0.29	* 0.0092	0.49	* 0.0001
Maple Syrup (PrN)	0.37	* 0.0003	0.35	* 0.0008
Montreal Biodome (PrE)	0.31	* 0.0034	0.39	* 0.0002
Canoe Trip (PrE)	0.32	* 0.0009	0.16	(n.s.) 0.1080
Whale-Watching (PrE)	0.55	* 0.0001	0.06	(n.s.) 0.5328

* significant at the 1% level; (n.s.) not significant at the 1% level.
PuN = Public Non-environmental Good; PuE = Public Non-environmental Good;
PrN = Private Non-environmental Good; PrE = Private Environmental Good.

4.3 DISCUSSION

The definition of a public good depends on many factors including property rights, market conditions and existing technologies (Rosen 1995). In the purest sense, public goods are completely nonrival and nonexcludable in consumption (Varian 1992). However, only some publicly-provided goods are purely nonrival and nonexcludable. Randall (1981) classifies goods only on their degree of rivalry and excludability. A grid with the percentage of nonrivalry along the horizontal axis and the percentage of nonexcludability along the vertical axis can be used to illustrate this idea (Figure 4.7). Pure private goods, located in the lower left corner, are 100% rival and 100% excludable. In contrast, pure public goods, located in the upper right corner, are 100% nonrival and 100% nonexcludable. Goods that fall within these extremes may be provided by either sector, or in some cases by not-for-profit organizations (Randall 1981).

Depending on the degree of rivalry and excludability, each of the twelve goods used in this experiment could be placed on a grid like the one shown in Figure 4.7. For example, maple syrup or the portable walkman are pure private goods and would be located in the lower left corner (Figure 4.8). Even though it is highly subsidized by the government, McGill University tuition was classified as a private good for the purposes of this experiment. While the three private environmental goods possess some degree of nonrivalry, they are excludable. Thus, these goods would be located along the bottom of the grid. The three public environmental goods are conservation programs that protect or improve common environmental resources. Programs of this nature are undertaken in the public interest and would normally be publicly funded. These programs are similar to pure public goods and would be clustered in the upper right corner of the grid. Finally, scattered around the upper half of the grid, the three public nonenvironmental goods have different degrees of nonrivalry and nonexcludability.

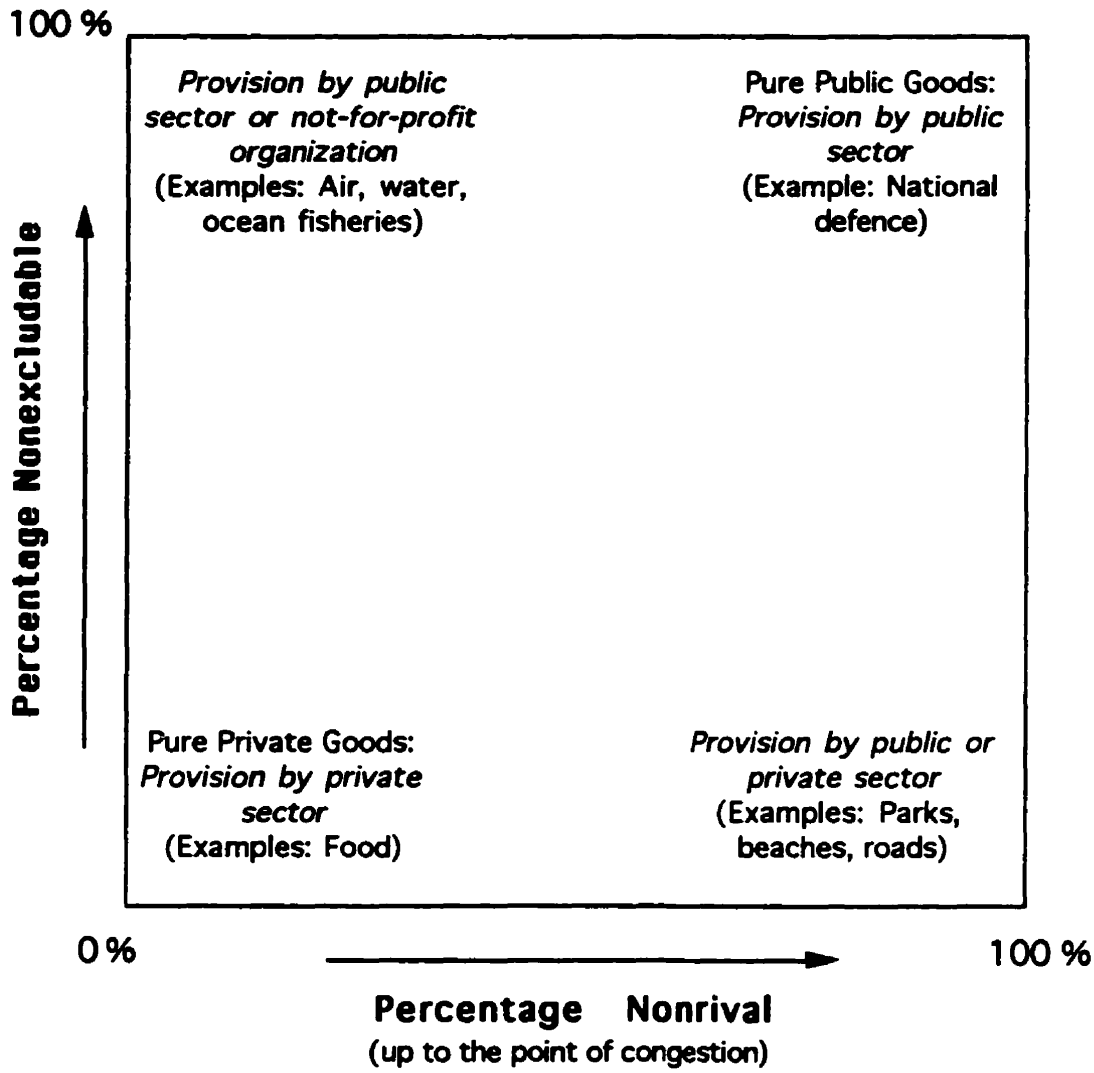


FIGURE 4.7. Relationship Between The Provision Of Goods And The Degree Of Rivalry And Excludability

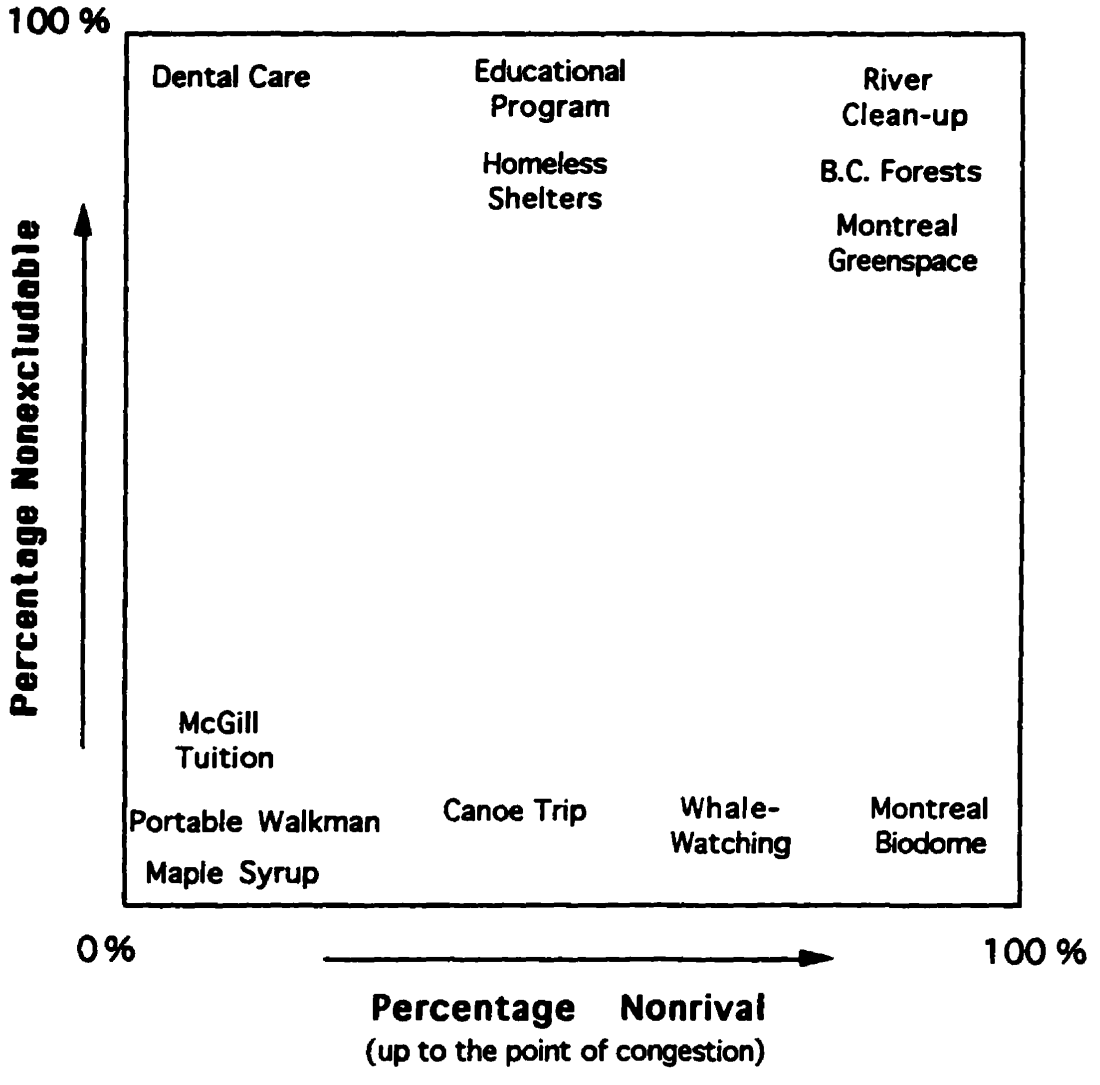


FIGURE 4.8. Relationship Between The Provision Of Goods And The Degree Of Rivalry And Excludability For The Hypothetical Goods Used In The Experiment

Surveys used in valuation studies are carefully designed to eliminate biases. In this experiment, however, specific biases were intentionally introduced into the survey to study how individuals might change their economic decision making behaviour in response to these biases. The results of this study show that only 50% of the goods were affected by any bias treatment, suggesting that for certain types of goods, WTP is stable and not easily influenced by the context in which value is elicited.

In terms of number of goods affected, value bias was stronger than information bias. Only two goods were affected by the information bias, whereas six goods were affected by the value bias. Moreover, when it had an effect, value bias reduced the maximum amount subjects were willing to pay for the good compared to the control subjects. Conversely, when the information treatment affected WTP, it increased maximum willingness-to-pay compared to the control group.

Although the results are preliminary, they suggest that valuation of goods with a high degree of nonexcludability, i.e., goods located along the upper half of Figure 4.7 can be influenced more by benefit bias than importance bias. In contrast, goods with a high degree of excludability, i.e., located along the lower half of Figure 4.7 may be less susceptible to the biases tested in this experiment and appear to be more influenced by importance bias than benefit bias.

Subjects in this experiment likely had difficulty assigning a monetary value to public goods, i.e., the goods located on the upper half of Figure 4.8. Since public goods are nonmarket goods, economic agents have no price signals to observe and may not even have well-defined preferences for the commodities being evaluated. Thus, individuals may rely more heavily on information provided at the time the value is elicited. For instance, information about sustainable development increased WTP and three attribute scores for the river clean-up, which was specifically mentioned in this reading. Moreover, WTP was positively correlated to two of these attributes, i.e., value precision and importance to Quebec. These results lend guarded support to the hypothesis that attributes that

are correlated to WTP can be similarly affected by biases that affect WTP. Furthermore, the Environment Canada document discussed how the average Canadian could take an active role to achieve sustainable development of environmental resources such as the St. Lawrence River. These results suggest that it may be possible to influence monetary values for certain environmental public goods by providing information that includes a call for action.

WTP for the educational program on health risks of cigarette smoking and alcohol use was also affected by the information bias, i.e., reading about sustainable development increased WTP. In contrast to the river clean-up, none of the attributes for the educational program were affected by the information bias, although four attributes were correlated to WTP. At first glance, this information bias effect may seem surprising. It was hypothesized that reading about sustainable development would increase stated WTP for environmental goods. However, the Environment Canada document also stressed that toxic items that can be found in any household and that individuals need to consider how their actions at home impact the health of the planet.

For years the government of Canada has been trying to inform young people about the health risks of smoking. When Health Canada evaluated generic packaging for cigarettes, focus groups discovered that warnings containing the word *toxic* were very powerful deterrents for young smokers (Health Canada 1992). It is plausible that the subjects who participated in this experiment would have similar reactions to the sustainable development article and the subsequent valuation questions for an educational program on the health risks of smoking cigarettes and drinking alcohol. However, since this was not the focus of this experiment, no questions were included in the questionnaire about attitudes toward smoking or alcohol consumption which would confirm this supposition. While equivocal, these results seem to support the hypothesis of many psychologists and decision researchers that consumers construct situation-dependent preferences for unfamiliar goods (Gregory et al. 1993).

An efficient allocation of public goods can be achieved even though marginal rates of substitution (MRSs) differ for each consumer. The societal demand curve for a public good is derived as the sum of individual MRSs for each quantity. When the total amount that members of a society are willing to pay for a public good equals the marginal rate of transformation, the good will be provided at an efficient level. The wording of WTP questions included in the questionnaire, therefore, specified that everyone in Canada would pay the same amount for public goods.

Unlike the situation with market goods, consumers have an incentive to hide their real WTP for public goods that are nonexcludable. When consumers state a WTP of zero, they can "ride for free" if the good is still provided at a level that satisfies them. Samuelson (1954) first described the free rider problem facing governments: Without the "self-policing competitive pricing of private goods", an incentive exists for an individual to "snatch some selfish benefit" by misstating his maximum willingness-to-pay for provision of public goods. Free rider behaviour can lead to an inefficient provision of public goods, if governments under or over estimate public demand.

In general, the observation that benefit bias reduced WTP for public goods could be interpreted as an indication of free rider behaviour. The correlation data tends to support this conclusion. WTP was not correlated to the personal benefit score for three of four public goods affected by the benefit bias.

None of the attribute scores for the Biodome pass were affected by value bias and no significant correlations between WTP and attribute scores were found for this good. Both the personal importance scores and personal benefit scores were positively correlated to WTP, as expected for a private good. Moreover, the description of the Biodome pass was the only one that specified actual cost for the item (see Table 4.2). Nevertheless, subjects specified WTP less than the price of the pass, and the mean score for value precision was the lowest of all goods included in the experiment. These responses suggests that subjects had little

interest in or little knowledge about the Montreal Biodome, and thus had little demand for this good.

Gregory, et al. (1992) found that importance and benefit were not perceived to be equivalent measures of value in their study. In addition, they observed that importance rated on a scale from zero to 100 was highly correlated to WTP rated on the same scale ($r=0.82$), but poorly correlated to an open-ended monetary value for WTP ($r=0.35$). Similarly, the study for this thesis found that importance was not as good a proxy for open-ended WTP (only six of the twelve goods had a significant correlation between the importance score and WTP). In fact, the importance bias shifted WTP downward while maintaining a positive correlation between WTP and the personal importance score for dental care, the portable walkman and the Montreal Biodome pass. The benefit bias reduced WTP primarily for public goods without any correlation between the personal benefit score and WTP. These results suggest that benefit bias and importance bias affect how individuals assign valuation differently. Whereas the benefit bias seems to create free rider behaviour, the importance bias may focus attention on a reference point from which subjects assign their monetary value for private goods.

4.4 CONCLUSION

The hypothesis that the sustainable development article would affect WTP for environmental goods was confirmed only for a public environmental good specifically mentioned in the article, i.e., the St. Lawrence River clean-up. Since Montreal is located on the St. Lawrence River, the effect of the reading may have been especially strong. Moreover, this was the only public good in the experiment described in terms of correcting environmental damage rather than preserving an environmental resource.

The hypothesis that eliciting nonmonetary values before the monetary value would bias stated WTP for different classes of goods was partially confirmed. WTP for public goods was twice as likely to be affected by the value biases, i.e., by asking about the personal

importance or personal benefit associated with the good. In all cases where WTP was affected, the bias decreased stated WTP. Asking about importance was a weaker bias than asking about benefit. The benefit bias appeared to induce free-riding behaviour for public goods in that the personal benefit bias reduced WTP more often for public goods compared to private goods. The importance bias, on the other hand, tended to affect primarily private goods. No discernible pattern of bias effects was found for environmental versus nonenvironmental goods.

Some attributes were affected by the biases. However, the hypothesis that biases significantly affecting WTP would also affect attributes that were correlated to WTP was only confirmed for the information bias for one of the twelve goods, the clean-up of the St. Lawrence River. One-half of the goods had one or more attributes correlated to WTP.

All significant correlations between attribute scores and WTP (11 of 72 correlations) were positive, except for two correlations between environmental impact and WTP which were negative, indicating WTP decreased as these goods were rated more harmful to the environment. Public goods tended to have lower mean scores for environmental impact, and higher mean scores for both Quebec and Canadian societal importance and duration of benefits than private goods. Furthermore, the societal importance attributes were correlated to WTP for public goods more often than for private goods. Finally, private goods were not observed to have a higher score for value precision than public goods.

The personal importance scores were significantly correlated to WTP more frequently for private goods, i.e., five of the six goods, than they were for public goods, i.e., one of six goods. Similarly, the personal benefit scores were also correlated to WTP more frequently for private goods than public goods, i.e., three private and one public good. When there were significant correlations, the importance and benefit scores were positively correlated to WTP. These results can also be interpreted as evidence of free-rider behaviour toward public goods. Moreover, there were no discernible differences in the number of significant correlations of WTP to

benefit or importance scores for environmental versus nonenvironmental goods.

GENERAL CONCLUSIONS

5.0 SUMMARY OF RESULTS

5.0.1 The Endowment Effect

The first hypothesis tested in this experiment, whether the endowment effect could be induced by transferring ownership of an item, was confirmed. However, the second hypothesis, that instructional wording would modify the endowment effect, was not confirmed.

5.0.2 The Effect of Biases on Willingness-to-Pay and Attribute Ranking

Several hypotheses were tested in this experiment. First, it was hypothesized that if subjects were given information about sustainable development, their subsequent monetary valuation of environmental goods or services would be upwardly biased. This hypothesis was only confirmed for the St. Lawrence River clean-up; the sustainable development article specifically mentioned the importance of St. Lawrence River as a public environmental resource.

Second, it was proposed that framing questions to elicit an initial nonmonetary value (personal importance or personal benefit) for a nonmarket (public) good would bias any subsequent monetary valuation of that good. This effect was not expected to be observed for market (private) goods. The results showed that this hypothesis was partially confirmed. WTP for twice as many public goods (4/6) as private goods (2/6) was affected by the value biases. In all cases where WTP was affected the bias decreased the stated WTP. Moreover, asking about personal importance was shown to be a weaker bias than asking about personal benefit.

Additionally, it was also hypothesized that the effect of the value bias would persist, influencing how subjects ranked attributes of nonmarket goods. The results showed that this hypothesis was

only confirmed for the information bias for one of the twelve goods, the clean-up of the St. Lawrence River. Furthermore, one-half of the goods had one or more attributes correlated to WTP. When there were significant correlations between the attribute scores and willingness-to-pay, the signs of the correlations were as expected, i.e., positive for four of the six attributes (value precision, the two societal importance attributes, and duration of benefits) and negative for environmental impact. The sixth attribute, scarcity, was not significantly correlated to WTP for any good.

Additionally, the hypothesis that societal importance attributes were correlated to WTP for public goods more than for private goods was confirmed. However, the hypothesis that the value precision scores of private goods would be higher than for public goods was not confirmed.

Finally, it was expected that personal importance and personal benefit scores would be positively correlated to WTP for private, but not public goods. The results tended to support this hypothesis. Personal importance scores were significantly correlated to WTP for more private goods (i.e., five of the six goods) than for public goods (i.e., one of six goods). Personal benefit scores were significantly correlated to WTP for three private goods and one public good. Furthermore, when there were significant correlations, the importance and benefit scores were positively correlated to WTP.

5.1 ECONOMIC IMPLICATIONS

The endowment effect experiment showed that subjects were reluctant to trade a good once it had been given to them. This effect was observed despite the overwhelming popularity of the McGill coffee cup. From the results of this thesis, it can be inferred that trades may differ depending on whether an individual gives up a possession or acquires a new item.

This behaviour could be restated in terms of WTP and WTA. Economic theory predicts that for the same item, WTP will equal WTA, if the income effect of the decision is zero. Since subjects

were told both goods had the same cost, it is reasonable to assume that there were no income effects for this experiment. Furthermore, based on the concept of revealed preference, individuals received equal or greater utility from the item they selected compared to the alternative item. In this experiment, however, individuals assigned a higher value to the loss of the possession (WTA the loss) than to the gain of a new item (WTP to acquire the item), as demonstrated by the reluctance to trade the chocolate bar when it was initially given to subjects. Moreover, from these results it can be inferred that a higher level of utility is associated with the decision to keep a possession. However, utility is an ordinal ranking of various bundles that can not be observed. It is possible that individuals making decisions outside of markets do not always maximize utility, but sometimes use other means to evaluate alternatives to reach a decision.

Observations from this experiment are consistent with Kahneman and Tversky's (1979) value function, and lend support to Thaler's (1991) proposal that assumptions economists make about preference ordering should be modified. Alternatively, since this experiment was not conducted in a familiar market setting, subjects may not have used a market reference point, but instead they may have constructed preferences for the item which they were given. This explanation would be consistent with the theories of psychologists and decision scientists.

Although equivocal, the results of the second experiment illustrate that WTP for public goods is more plastic than WTP for private goods. Subjects showed a greater tendency to adjust their valuation of nonmarket goods in response to biases. WTP is a measure of the Marshallian demand, i.e., it corresponds to the price consumers would pay for an additional unit of a commodity, all else being constant. From a Marshallian demand function, it is possible to derive an associated utility function (Figure 2.1). However, it is often difficult to solve the differential equation used to derive the indirect utility function and the utility function that describes the underlying preferences.

Given perfect information, a rational consumer will always select the consumption bundle that is most preferred over all other available bundles within his budget set. The concept of a most preferred bundle rests on the implicit assumption that consumers can evaluate and prioritize bundles in their budget set. With nonmarket goods, however, this is questionable. Preferences are assumed stable within the time frame of the model. Economists recognize that tastes can change in response to changes in experiences and technology. As information can be obtained more quickly and at lower costs, individuals may be revising their preferences faster than assumed by standard economic choice models.

It would be reasonable to assume that subjects were more familiar with market goods than the nonmarket goods and could thus assign precise monetary values to market goods. However, when mean value precision scores were ranked, subjects indicated they had the most precise sense of value for McGill University tuition and the portable Walkman, but the most imprecise sense of value for the other four private goods. Subjects tended to specify higher WTP for public goods that were ranked as important to society.

Much of the criticism of CVM studies focuses on the unrealistic values that are elicited, especially for environmental damage assessment. Fischhoff (1991) asserted that using the wrong paradigm to measure values can elicit meaningless results. Diamond and Hausman's (1994) suggested that consumers do not have preferences for unknown nonmarket goods. Thus, it is not surprising that CVM surveys could elicit distorted monetary values for nonmarket goods.

Without clear preferences, consumers appear to use the different attributes of the good, such as societal importance, to estimate the amount they would be willing to pay for the nonmarket good. For environmental resources, total economic value (TEV) is not based only on the consumption value of the good, but also the option and existence values of the good. Direct elicitation of monetary value, i.e., WTP, is the only way that economists can measure these nonuse values. Brookshire and McKee (1994) argue

that purely competitive markets put a structure on behaviour which in a nonmarket situation might appear to violate neoclassical theory.

5.2 LIMITATIONS OF THIS STUDY

Due to limited funds, these two experiments were conducted using the same subjects. To keep the questionnaire a reasonable length, only twelve goods and six attributes were used for the study on the effect of biases. Nevertheless, the experiments lasted at least one hour. Had more funds been available, the two experiments would have been conducted separately.

Furthermore, most of the goods chosen for the experiment had many dimensions, making evaluation difficult for some subjects. To minimize experimental bias in the questionnaire itself, all questions followed the same format. This resulted in a mismatch between some of the attribute questions and the type of good. For example, the environmental impact questions seemed inappropriate for the nonenvironmental goods. Again, if more funds had been available, the experiment on biases could have been conducted with more subjects. In this case each questionnaire could have been shorter and the goods could have been described in more depth. In addition, a simulated market component could have been added to elicit less hypothetical responses.

Questions for the bias experiment should have included a more obvious reference point, e.g., questions could have been phrased such that there was a clear definition of whether the item involved a gain or a loss. Only one public good described environmental damage. It would have been interesting to systematically test losses and gains from a reference point. This would have required more subjects.

Finally, although coffee cups and candy bars have been used by other researchers in similar experiments on the endowment effect, a cup lasts much longer than a candy bar. Giving subjects a choice between two goods with both similar monetary value and duration of service might have yielded different results.

5.3 RECOMMENDATIONS FOR FUTURE RESEARCH

More research should be conducted to determine if studies demonstrating the endowment effect are really measuring preferences. Experiments which determine the attributes of goods that induce the effect would be particularly valuable. Specifically, this experiment could be repeated using goods with a similar duration of service.

Considerable progress could be made from interdisciplinary research which integrates the expertise of economists, psychologists and other decision theorists. Economists should evaluate decision making theories from other fields to develop economic models that more accurately predict consumers' economic decisions for nonmarket goods.

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APPENDIX A. SAMPLE INSTRUCTIONS - - EXPERIMENT ONE AND CONSENT FORM

TREATMENT GROUP 1A

INSTRUCTIONS

You are participating in an experiment on economic decision making that is being conducted for a master's thesis. The experiment will last approximately one hour and you will be paid $10 for your participation. Funding has been provided by the Department of Agricultural Economics of McGill University.

Each of you has been given a coffee cup and a questionnaire. Please examine the coffee cup at this time.

We will begin the questionnaire momentarily. There are no right or wrong answers. PLEASE FOLLOW ALL INSTRUCTIONS CAREFULLY. Raise your hand if you have any questions. As you complete each section of the questionnaire, please place it face down on the table to your left. However, once you have begun a new section, DO NOT RETURN TO ANY PREVIOUS SECTION.

When the experiment is over, you will be paid. Please leave all questionnaires and pencils on your desk. However, THE COFFEE CUP IS YOURS TO KEEP WHEN YOU LEAVE.

Thank you for your participation. **Please complete the attached consent form and put it on the left side of your desk.** We will collect this form while you are completing the questionnaire.

TREATMENT GROUP 1B

INSTRUCTIONS

You are participating in an experiment on economic decision making that is being conducted for a master's thesis. The experiment will last approximately one hour and you will be paid $10 for your participation. Funding has been provided by the Department of Agricultural Economics of McGill University.

Each of you has been given a candy bar and a questionnaire. Please examine the candy bar at this time.

We will begin the questionnaire momentarily. There are no right or wrong answers. PLEASE FOLLOW ALL INSTRUCTIONS CAREFULLY. Raise your hand if you have any questions. As you complete each section of the questionnaire, please place it face down on the table to your left. However, once you have begun a new section, DO NOT RETURN TO ANY PREVIOUS SECTION.

When the experiment is over, you will be paid. Please leave all questionnaires and pencils on your desk. However, THE CANDY BAR IS YOURS TO KEEP WHEN YOU LEAVE.

Thank you for your participation. **Please complete the attached consent form and put it on the left side of your desk.** We will collect this form while you are completing the questionnaire.

TREATMENT GROUP 2A

INSTRUCTIONS

You are participating in an experiment on economic decision making that is being conducted for a master's thesis. The experiment will last approximately one hour and you will be paid $10 for your participation. Funding has been provided by the Department of Agricultural Economics of McGill University.

Each of you has been given a coffee cup and a questionnaire. Please examine the coffee cup at this time.

We will begin the questionnaire momentarily. There are no right or wrong answers. PLEASE FOLLOW ALL INSTRUCTIONS CAREFULLY. Raise your hand if you have any questions. As you complete each section of the questionnaire, please place it face down on the table to your left. However, once you have begun a new section, DO NOT RETURN TO ANY PREVIOUS SECTION.

After everyone has completed section 1 of the questionnaire, YOU WILL BE ABLE TO TRADE THE COFFEE CUP FOR A 400GM MILK CHOCOLATE CANDY BAR.

When the experiment is over, you will be paid. Please leave all questionnaires and pencils on your desk. Any object you acquire during the experiment will be yours to keep when you leave.

Thank you for your participation. **Please complete the attached consent form and put it on the left side of your desk.** We will collect this form while you are completing the questionnaire.

TREATMENT GROUP 2B

INSTRUCTIONS

You are participating in an experiment on economic decision making that is being conducted for a master's thesis. The experiment will last approximately one hour and you will be paid $10 for your participation. Funding has been provided by the Department of Agricultural Economics of McGill University.

Each of you has been given a candy bar and a questionnaire. Please examine the candy bar at this time.

We will begin the questionnaire momentarily. There are no right or wrong answers. PLEASE FOLLOW ALL INSTRUCTIONS CAREFULLY. Raise your hand if you have any questions. As you complete each section of the questionnaire, please place it face down on the table to your left. However, once you have begun a new section, DO NOT RETURN TO ANY PREVIOUS SECTION.

After everyone has completed section 1 of the questionnaire, YOU WILL BE ABLE TO TRADE THE CANDY BAR FOR A PLASTIC MCGILL COFFEE CUP.

When the experiment is over, you will be paid. Please leave all questionnaires and pencils on your desk. Any object you acquire during the experiment will be yours to keep when you leave.

Thank you for your participation. **Please complete the attached consent form and put it on the left side of your desk.** We will collect this form while you are completing the questionnaire.

TREATMENT GROUP 3

INSTRUCTIONS

You are participating in an experiment on economic decision making that is being conducted for a master's thesis. The experiment will last approximately one hour and you will be paid $10 for your participation. Funding has been provided by the Department of Agricultural Economics of McGill University.

Each of you has been given a questionnaire. We will begin the questionnaire momentarily. There are no right or wrong answers for these questions. Answer them as though the situation was real. PLEASE FOLLOW ALL INSTRUCTIONS CAREFULLY. Raise your hand if you have any questions. However, once you have begun a new section, DO NOT RETURN TO ANY PREVIOUS SECTION.

When the experiment is over, you will be paid. Please leave all questionnaires and pencils on your desk. Any object you acquire during the experiment will be yours to keep when you leave.

Thank you for your participation. **Please complete the attached consent form and put it on the left side of your desk.** We will collect this form while you are completing the questionnaire.

TREATMENT GROUP 4

INSTRUCTIONS

You are participating in an experiment on economic decision making that is being conducted for a master's thesis. The experiment will last approximately one hour and you will be paid $10 for your participation. Funding has been provided by the Department of Agricultural Economics of McGill University.

Each of you has been given a coffee cup, a candy bar and a questionnaire. The coffee cup and candy bar cost approximately the same amount. Please examine them at this time.

We will begin the questionnaire momentarily. There are no right or wrong answers. PLEASE FOLLOW ALL INSTRUCTIONS CAREFULLY. Raise your hand if you have any questions. As you complete each section of the questionnaire, please place it face down on the table to your left. However, once you have begun a new section, DO NOT RETURN TO ANY PREVIOUS SECTION.

After everyone has completed section 1 of the questionnaire, you must give up EITHER the candy bar or the coffee cup. However, THE ITEM YOU DO NOT GIVE UP IS YOURS TO KEEP WHEN YOU LEAVE.

When the experiment is over, you will be paid. Please leave all questionnaires and pencils on your desk.

Thank you for your participation. **Please complete the attached consent form and put it on the left side of your desk.** We will collect this form while you are completing the questionnaire.

CONSENT FORM

I agree to participate in an "Economic Decision Making Experiment and Survey" being conducted by the Department of Agricultural Economics of McGill University. I understand that all information that I provide will be confidential.

Name (please print): _____

Signature: _____

Date: _____

APPENDIX B. SAMPLE QUESTIONNAIRE - - EXPERIMENT ONE

Section 1

There are 10 questions in this section. Please answer each question as though the situation was real. Raise you hand if you have any questions. WHEN YOU HAVE FINISHED THIS SECTION, PLEASE STOP UNTIL GIVEN FURTHER INSTRUCTIONS.

For the next two questions, fill in the blank with your answer.

1) What do you think is the most important problem facing Canada today?

_____

2) What do you think is the most important problem facing Quebec today?

_____

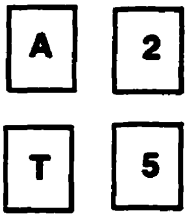
For the next four questions, circle the letter of the alternative that you would choose if you were actually faced with the choice.

3) If you were faced with the following choice, which alternative would you choose?
   a) A sure loss of $750.
   b) 76 percent chance to lose $1,000 and a 24 percent chance to lose nothing.

4) If you were faced with the following choice, which alternative would you choose?
   a) 100 percent chance to gain $500.
   b) 25 percent chance to gain $2,000 and a 75 percent chance to gain nothing.

5) If you were faced with the following choice, which alternative would you choose?
   a) A sure gain of $1,000,000.
   b) 10 percent chance to gain $2,500,000, 89 percent chance to gain $1,000,000 and a 1 percent chance to gain nothing.

6) If you were faced with the following choice, which alternative would you choose?
   a) 100 percent chance to lose $500.
   b) 25 percent chance to lose $2,000 and a 75 percent chance to lose nothing.



7) Suppose that each card shown above had a letter on one side and a number on the other side. You are told: "If a card has a vowel on one side, then it has an even number on the other side." Which of the cards would you need to turn over in order to decide if the person is lying? Check the box corresponding to the cards you would turn over.

- ☐ A
- ☐ T
- ☐ 2
- ☐ 5

8) If you **unexpectedly received $100**, indicate the amount you would spend on the following items. (Zero is an acceptable answer.)

Item:	**Amount you would spend on this item ($100 total)**
Textbooks	
Compact disks or cassettes	
Expand the number of journals available at McGill University libraries	
New clothes	
Charitable organization	
Other	

9) Which level(s) of government do you think is (are) CURRENTLY PAYING for the following goods or services? Check the box that corresponds to your answer.

Good or Service:	Federal	Provincial	Both	Don't Know	Neither
Protection of Endangered Species					
Agricultural Support Programs					
Higher Education					
Parks					
Environmental Quality					
Income Security					
Job Training Programs					

10) Which level(s) of government do you think SHOULD BE PAYING for the following goods or services? Check the box that corresponds to your answer.

Good or Service:	Federal	Provincial	Both	Don't Know	Neither
Protection of Endangered Species					
Agricultural Support Programs					
Higher Education					
Parks					
Environmental Quality					
Income Security					
Job Training Programs					

STOP! PLEASE WAIT FOR INSTRUCTIONS BEFORE STARTING THE NEXT SECTION.

APPENDIX C. PROFILE OF SUBJECTS

Table C.1. Living Situation Of Subjects

	Number of Students	Percent of Students
Live in Montreal?		
Yes	113	67.7%
No	50	29.9%
No Response	4	2.4%
Total	167	100.0%
Living with Family?		
Yes	87	52.1%
No	79	47.3%
No Response	1	0.6%
Total	167	100.0%
Type of Housing:		
Living with Family		
Apartment	19	21.8%
House	65	74.7%
Other	3	3.4%
Total	87	100.0%
Not Living with Family		
Apartment	72	91.1%
House	3	3.8%
Other	4	5.1%
Total	79	100.0%

Table C.2. Language Profile Of Subjects

	Number of Students	Percent of Students
Mother Tongue:		
English	87	52.1%
French	21	12.6%
Greek	8	4.8%
Chinese	14	8.4%
Other	37	22.2%
Total	167	100.0%
Bilingual? (All Subjects)		
Yes	120	71.9%
No	47	28.1%
Total	167	100.0%
Principal Language Spoken:		
English	147	88.0%
French	11	6.6%
English/French	6	3.6%
Other	1	0.6%
No Response	2	1.2%
Total	167	100.0%

APPENDIX D. EXPERIMENT TWO - - SAMPLE QUESTIONNAIRE

Section 3

There are three questions in this section. Please answer each question as though the situation was real. Circle the letter of the alternative that you would choose.

1) If you were faced with the following choice, which alternative would you choose?

   a) 25 percent chance to gain $1000 and a 75 percent chance to gain nothing.

   b) 100 percent chance to gain $240.

2) If you were faced with the following choice, which alternative would you choose?

   a) 10 percent chance to gain $2,500,000 and a 90 percent chance to gain nothing.

   b) 11 percent chance to gain $1,000,000 gain and 89 percent chance to gain nothing.

3) If you were faced with the following choice, which alternative would you choose?

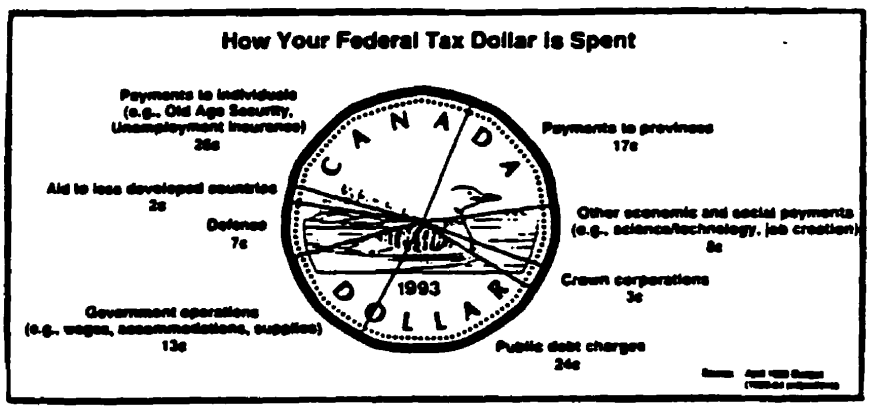
   a) 80 percent chance to lose $125 and a 20 percent chance to lose nothing.

   b) 100 percent chance to lose $100.

Section 4

In this section you are asked to rate your satisfaction with the level of spending of the federal government. Please place a check in the square that corresponds to your answer.

1) The following pie chart provides a general indication of Canadian federal expenditures for 1993-1994.



Is the Canadian government spending too little, just right, or too much on the following areas?

Area:	too little	just right	too much	don't know
Payments to provinces				
Public debt charges				
Aid to less developed countries				
Job creation programs				
Government operations				
Unemployment insurance				

Section 6

In this section you are asked to rate several environmental indicators. Place a check in the square indicating your answer.

1) How would you **compare** the condition of Canada's environment to that of the United States with respect to the following indicators?

Environmental Indicator	Better	Same	Worse
Intensity of use of forest resources (harvest / annual growth)			
CO_2 emissions from energy use (per capita emissions in tonnes)			
Protected land areas: parks, reserves, etc. (percentage of total land area)			
Water use (per capita use in cubic metres)			
Quantity of municipal waste (per capita waste in kilograms)			
Percent change in the use of nitrogenous fertilizers since 1970			

Section 7

1) How many times does the letter "f" appear in the following sentence?

These functional fuses have been developed after years of scientific investigation of electric phenomena, combined with the fruit of long experience on the part of the two investigators who have come forward with them for our meetings today.

The letter "f" appears _____ times.

Section 8

In this section there are six questions about twelve different goods. Please circle the number that corresponds to your answer.

In the following example, if you have no idea what value ten additional bike lanes in Calgary are to you, circle the number 1. Circle the number 4 if you have a moderate sense of the value these bike lanes are to you. However, if you know exactly what value these additional bike lanes are to you, circle the number 7.

1) Ten additional bike lanes in downtown Calgary, Alberta:

   a) How precise is your sense of the value to you of ten additional bike lanes in downtown Calgary?

imprecise 1 2 3 4 5 6 7 *very precise*

1) Yearly Medicare-funded dental examinations (including teeth cleaning) for all individuals:

a) How important to Canadian society are yearly Medicare-funded dental examinations for all individuals, compared with not having them?

unimportant 1 2 3 4 5 6 7 *very important*

b) How rare / common are yearly Medicare-funded dental examinations for all individuals?

rare 1 2 3 4 5 6 7 *common*

c) Once yearly Medicare-funded dental examinations for all individuals have been acquired, how long do most of their benefits occur?

immediately 1 2 3 4 5 6 7 *forever*

d) How important to the people of Quebec are yearly Medicare-funded dental examinations for all individuals, compared with not having them?

unimportant 1 2 3 4 5 6 7 *very important*

e) How precise is your sense of the value to you of yearly Medicare-funded dental examinations for all individuals?

imprecise 1 2 3 4 5 6 7 *very precise*

f) How beneficial / harmful to the natural environment are yearly Medicare-funded dental examinations for all individuals?

beneficial 1 2 3 4 5 6 7 *harmful*

2) A three-credit course at McGill University:

a) How important to Canadian society is a three-credit course at McGill University, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

b) How rare / common is a three-credit course at McGill University?

rare 1 2 3 4 5 6 7 *common*

c) Once a three-credit course at McGill University has been acquired, how long do most of its benefits occur?

immediately 1 2 3 4 5 6 7 *forever*

d) How important to the people of Quebec is a three-credit course at McGill University, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

e) How precise is your sense of the value to you of a three-credit course at McGill University?

imprecise 1 2 3 4 5 6 7 *very precise*

f) How beneficial / harmful to the natural environment is a three-credit course at McGill University?

beneficial 1 2 3 4 5 6 7 *harmful*

3) A $35.00 pass for unlimited entries into the Biodôme de Montréal for one year:

a) How important to Canadian society is a $35.00 pass for unlimited entries into the Biodôme for one year, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

b) How rare / common is a $35.00 pass for unlimited entries into the Biodôme for one year?

rare 1 2 3 4 5 6 7 *common*

c) Once a $35.00 pass for unlimited entries into the Biodôme for one year has been acquired, how long do most of its benefits occur?

immediately 1 2 3 4 5 6 7 *forever*

d) How important to the people of Quebec is a $35.00 pass for unlimited entries into the Biodôme for one year, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

e) How precise is your sense of the value to you of a $35.00 pass for unlimited entries into the Biodôme for one year?

imprecise 1 2 3 4 5 6 7 *very precise*

f) How beneficial / harmful to the natural environment is a $35.00 pass for unlimited entries into the Biodôme for one year?

beneficial 1 2 3 4 5 6 7 *harmful*

4) A two-year educational program on health risks associated with smoking cigarettes and drinking alcohol:

a) How important to Canadian society is a two-year educational program on health risks associated with smoking cigarettes and drinking alcohol, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

b) How rare / common is a two-year educational program on health risks associated with smoking cigarettes and drinking alcohol?

rare 1 2 3 4 5 6 7 *common*

c) Once a two-year educational program on health risks associated with smoking cigarettes and drinking alcohol has been acquired, how long do most of its benefits occur?

immediately 1 2 3 4 5 6 7 *forever*

d) How important to the people of Quebec is a two-year educational program on health risks associated with smoking cigarettes and drinking alcohol, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

e) How precise is your sense of the value to you of a two-year educational program on health risks associated with smoking cigarettes and drinking alcohol?

imprecise 1 2 3 4 5 6 7 *very precise*

f) How beneficial / harmful to the natural environment is a two-year educational program on health risks associated with smoking cigarettes and drinking alcohol?

beneficial 1 2 3 4 5 6 7 *harmful*

5) A substantial improvement in the water quality of the St. Lawrence River over the next five years:

a) How important to Canadian society is a substantial improvement in the water quality of the St. Lawrence River over the next five years, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

b) How rare / common is a substantial improvement in the water quality of the St. Lawrence River over the next five years?

rare 1 2 3 4 5 6 7 *common*

c) Once a substantial improvement in the water quality of the St. Lawrence River over the next five years has been acquired, how long do most of its benefits occur?

immediately 1 2 3 4 5 6 7 *forever*

d) How important to the people of Quebec is a substantial improvement in the water quality of the St. Lawrence River over the next five years, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

e) How precise is your sense of the value to you of a substantial improvement in the water quality of the St. Lawrence River over the next five years?

imprecise 1 2 3 4 5 6 7 *very precise*

f) How beneficial / harmful to the natural environment is a substantial improvement in the water quality of the St. Lawrence River over the next five years?

beneficial 1 2 3 4 5 6 7 *harmful*

6) A three-year program of shelters for homeless youth in urban centers throughout Canada:

a) How important to Canadian society is a three-year program of shelters for homeless youth in urban centers throughout Canada, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

b) How rare / common is a three-year program of shelters for homeless youth in urban centers throughout Canada?

rare 1 2 3 4 5 6 7 *common*

c) Once a three-year program of shelters for homeless youth in urban centers throughout Canada has been acquired, how long do most of its benefits occur?

immediately 1 2 3 4 5 6 7 *forever*

d) How important to the people of Quebec is a three-year program of shelters for homeless youth in urban centers throughout Canada, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

e) How precise is your sense of the value to you of a three-year program of shelters for homeless youth in urban centers throughout Canada?

imprecise 1 2 3 4 5 6 7 *very precise*

f) How beneficial / harmful to the natural environment is a three-year program of shelters for homeless youth in urban centers throughout Canada?

beneficial 1 2 3 4 5 6 7 *harmful*

7) A permanent program for the conservation of old-growth forests in British Columbia:

a) How important to Canadian society is a permanent program for the conservation of old-growth forests in British Columbia, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

b) How rare / common is a permanent program for the conservation of old-growth forests in British Columbia?

rare 1 2 3 4 5 6 7 *common*

c) Once a permanent program for the conservation of old-growth forests in British Columbia has been acquired, how long do most of its benefits occur?

immediately 1 2 3 4 5 6 7 *forever*

d) How important to the people of Quebec is a permanent program for the conservation of old-growth forests in British Columbia, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

e) How precise is your sense of the value to you of a permanent program for the conservation of old-growth forests in British Columbia?

imprecise 1 2 3 4 5 6 7 *very precise*

f) How beneficial / harmful to the natural environment is a permanent program for the conservation of old-growth forests in British Columbia?

beneficial 1 2 3 4 5 6 7 *harmful*

8) A Walkman portable cassette player:

a) How important to Canadian society is a Walkman portable cassette player, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

b) How rare / common is a Walkman portable cassette player?

rare 1 2 3 4 5 6 7 *common*

c) Once a Walkman portable cassette player has been acquired, how long do most of its benefits occur?

immediately 1 2 3 4 5 6 7 *forever*

d) How important to the people of Quebec is a Walkman portable cassette player, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

e) How precise is your sense of the value to you of a Walkman portable cassette player?

imprecise 1 2 3 4 5 6 7 *very precise*

f) How beneficial / harmful to the natural environment is a Walkman portable cassette player?

beneficial 1 2 3 4 5 6 7 *harmful*

9) A three-day canoe trip led by Algonquin guides on the Harricana River in the Abitibi region of northern Quebec:

a) How important to Canadian society is a three-day canoe trip led by Algonquin guides on the Harricana River, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

b) How rare / common is a three-day canoe trip led by Algonquin guides on the Harricana River?

rare 1 2 3 4 5 6 7 *common*

c) Once a three-day canoe trip led by Algonquin guides on the Harricana River has been acquired, how long do most of its benefits occur?

immediately 1 2 3 4 5 6 7 *forever*

d) How important to the people of Quebec is a three-day canoe trip led by Algonquin guides on the Harricana River, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

e) How precise is your sense of the value to you of a three-day canoe trip led by Algonquin guides on the Harricana River?

imprecise 1 2 3 4 5 6 7 *very precise*

f) How beneficial / harmful to the natural environment is a three-day canoe trip led by Algonquin guides on the Harricana River?

beneficial 1 2 3 4 5 6 7 *harmful*

10) A permanent program for the protection of forested greenspace on Mount Royal in Montreal:

a) How important to Canadian society is a permanent program for the protection of forested greenspace on Mount Royal, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

b) How rare / common is a permanent program for the protection of forested greenspace on Mount Royal?

rare 1 2 3 4 5 6 7 *common*

c) Once a permanent program for the protection of forested greenspace on Mount Royal has been acquired, how long do most of its benefits occur?

immediately 1 2 3 4 5 6 7 *forever*

d) How important to the people of Quebec is a permanent program for the protection of forested greenspace on Mount Royal, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

e) How precise is your sense of the value to you of a permanent program for the protection of forested greenspace on Mount Royal?

imprecise 1 2 3 4 5 6 7 *very precise*

f) How beneficial / harmful to the natural environment is a permanent program for the protection of forested greenspace on Mount Royal ?

beneficial 1 2 3 4 5 6 7 *harmful*

11) A half-day cruise from Tadoussac, Quebec to see the beluga whales in the St. Lawrence River:

a) How important to Canadian society is a half-day cruise to see the beluga whales, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

b) How rare / common is a half-day cruise to see the beluga whales?

rare 1 2 3 4 5 6 7 *common*

c) Once a half-day cruise to see the beluga whales has been acquired, how long do most of its benefits occur?

immediately 1 2 3 4 5 6 7 *forever*

d) How important to the people of Quebec is a half-day cruise to see the beluga whales, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

e) How precise is your sense of the value to you of a half-day cruise to see the beluga whales?

imprecise 1 2 3 4 5 6 7 *very precise*

f) How beneficial / harmful to the natural environment is a half-day cruise to see the beluga whales?

beneficial 1 2 3 4 5 6 7 *harmful*

12) A 4-litre container of #1 clear Quebec maple syrup:

a) How important to Canadian society is a 4-litre container of #1 clear Quebec maple syrup, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

b) How rare / common is a 4-litre container of #1 clear Quebec maple syrup?

rare 1 2 3 4 5 6 7 *common*

c) Once is a 4-litre container of #1 clear Quebec maple syrup have been acquired, how long do most of its benefits occur?

immediately 1 2 3 4 5 6 7 *forever*

d) How important to the people of Quebec is a 4-litre container of #1 clear Quebec maple syrup, compared with not having it?

unimportant 1 2 3 4 5 6 7 *very important*

e) How precise is your sense of the value to you of is a 4-litre container of #1 clear Quebec maple syrup?

imprecise 1 2 3 4 5 6 7 *very precise*

f) How beneficial / harmful to the natural environment is a 4-litre container of #1 clear Quebec maple syrup?

beneficial 1 2 3 4 5 6 7 *harmful*

Section 9

Please complete the following questions by filling in the blank or checking the appropriate box.

Your age:

- ☐ 17 - 19
- ☐ 20 - 22
- ☐ 23 - 25
- ☐ 26 - 28
- ☐ 29 - 31
- ☐ 32 - 34
- ☐ 35 - 37
- ☐ 38 - 40
- ☐ 41 - 43
- ☐ 44 - 46
- ☐ 47 - 49
- ☐ 50 years and up

Sex : ☐ M ☐ F

Citizenship: _____

What is your highest level of education: _____

Field of study, if applicable: _____

Will you be a full-time student September, 1994? ☐ Yes ☐ No

If yes:

Year of study:

- ☐ U-1 ☐ U-2 ☐ U-3
- ☐ Other (please specify: _____)

Degree program:

- ☐ B.A. ☐ B.Sc.
- ☐ Other (please specify: _____)

Job title (if employed): _____

Your annual income:

- ☐ $0 - $2,499
- ☐ $2,500 - $4,999
- ☐ $5,000 - $7,499
- ☐ $7,500 - $9,999
- ☐ $10,000 - $12,499
- ☐ $12,500 - $14,999
- ☐ $15,000 - $17,499
- ☐ $17,500 - $19,999
- ☐ $20,000 - $22,499
- ☐ $22,500 - $24,999
- ☐ $25,000 - $27,499
- ☐ $27,500 - $29,999
- ☐ $30,000 and up

Mother tongue: _____

Are you bilingual in French and English? ☐ Yes ☐ No

Principal language that you speak: _____

Do you live with your parents, grandparents or other family members? ☐ Yes ☐ No

Where do you live?

- ☐ on-campus residence
- ☐ apartment or condominium
- ☐ house
- ☐ Other (please specify:) _____

Size of your household (number of people with whom you live): _____

Household weekly food expenditure: _____

In what city / town do you live? _____

Total annual household income (i.e., the total income of all people with whom you live):

- ☐ $0 - $4,999
- ☐ $5,000 - $9,999
- ☐ $10,000 - $14,999
- ☐ $15,000 - $19,999
- ☐ $20,000 - $24,999
- ☐ $25,000 - $29,999
- ☐ $30,000 - $34,999
- ☐ $35,000 - $39,999
- ☐ $40,000 - $44,999
- ☐ $45,000 - $49,999
- ☐ $50,000 and up

What do you think is the most important problem facing Canada today?

_____

What do you think is the most important problem facing Quebec today?

_____

Are you a member of any environmental organization? ☐ Yes ☐ No

If yes, please specify: _____

APPENDIX E. EXPERIMENT TWO - - INFORMATION BIAS: SUSTAINABLE DEVELOPMENT ARTICLE AND TITANIC (CONTROL) ARTICLE

Section 2 - - Sustainable Development Article

PLEASE READ THE FOLLOWING INFORMATION CAREFULLY. You will be asked questions later about the material in the article. When you have finished reading you may begin the next section of the questionnaire.

Excerpts from *Toward A Common Future: A Report on Sustainable Development and Its Implications for Canada* by Michael Keating

EVERYONE IS INVOLVED

Global atmospheric pollution means there is no longer a Shangri-la, a corner of the world where you can go and say that the ravages of pollution cannot touch you. We all are exposed to the hazards of pollution so we must all be involved in a major change in business practices and lifestyles to reduce human impact on the environment.

This is true even in Canada, which has less than one half of one per cent of the world's population on seven per cent of the world's land mass. Despite the apparent wide-open spaces, all regions of Canada have some environmental problems. Climate change, the thinning ozone layer and toxic wastes affect the whole country. Forestry and fishery shortages keep cropping up in one area after another. Almost all urban areas are having a difficult time finding new dumpsites.

The Atlantic provinces suffer from inadequate sewage treatment, from leaking underground oil storage tanks and from agricultural chemicals and industrial wastes seeping into drinking water. Acid rain has already destroyed life in several Nova Scotia salmon rivers.

In Quebec and Ontario acid rain is a major issue, threatening life in hundreds of thousands of lakes and rivers. Unsafe chemical storage is a serious problem as the fire at a PCB storage depot at Saint-Basile-le-Grand showed in 1988. Chemical pollution, human and livestock wastes make some waters questionable or even clearly unfit to drink. In many parts of the Great Lakes-St. Lawrence ecosystem fish are either unsafe to eat or are fit only for limited consumption. Dead beluga whales in the St. Lawrence estuary are so laden with chemicals that they qualify as hazardous waste sites.

Across the Prairie provinces regional water shortages and the loss of valuable topsoils leap to the head of the list. The effects of agricultural chemicals in the land and water and the loss of wildlife habitat in the continent's greatest natural duck hatchery are also issues of regional and national concern.

Heated controversy keeps flaring up in British Columbia over how much of the impressive virgin forests, which hold some of the biggest trees anywhere, should be preserved. These disputes are often entwined with native land claims.

In the Yukon and Northwest Territories there is relatively little obvious environmental damage in comparison to the vast areas still in a relatively pristine state. Air pollution known as Arctic haze periodically thickens with wastes blown from industrial areas thousands of kilometres away. Radioactive fallout from past atmospheric weapons tests and from the Chernobyl power plant accident are being passed through the Arctic food chain.

Many serious environmental issues, such as climate change, ozone depletion, acid rain, transboundary water quality, protection of wilderness and migratory species, lie beyond the control of a single nation or region. Children in Moose Jaw or Chicoutimi are going to be dramatically affected by what the adults in Toronto, Pittsburgh, Moscow, Beijing, Brasilia and Tokyo do. They will get skin cancer if the world does not save the ozone layer. Their weather will change if the industrial centres do not stop injecting billions of tonnes of pollution a year into the sky, creating the greenhouse effect.

IMPLICATIONS FOR INDIVIDUAL BEHAVIOR

While big government and big business are often seen as the key actors in bringing change, the individual citizen has the most important role of all. Governments and companies are made up of individuals and are guided by their decisions.

People are now bombarded with information about problems, but there is a dearth of public information about solutions. As a result many citizens take the attitude that there is little they can do to save the environment, instead of realizing that the problems will be solved only by a myriad individual actions.

At the home front each individual's contribution to pollution control and energy reduction is small in isolation. But when you multiply the number of individuals the effect is immense.

Most households have enough chemicals in them to start a small but lethal laboratory. These include: paints and paint thinners, insect and weed killers, anti-freeze, chlorine bleach, nail polish, oven cleaners, mildew removers, rust dissolvers and a dozen other household products, many labelled as poisonous, corrosive or explosive. Some of them, such as toilet bowl and drain cleaners, are deliberately poured into the water system, often in far greater amounts than are really needed. The green lawn syndrome has led homeowners to pour herbicides and chemical fertilizers on their lawns. Part of that chemical load is washed off into the sewers and then into the lakes from which we drink.

Partly empty cans of insect sprays, mercury and cadmium batteries, radioactive smoke detectors and hundreds of other materials go into municipal landfill dumps where they pose a long-term hazard of leakage. If burned in municipal incinerators they become an air pollution problem. Each consumer of hazardous products is also responsible for a share of the wastes which flow from the factories where the products are made.

Many changes can be made immediately in the home. You can eliminate or reduce the use of products labelled poisonous, corrosive, explosive or highly flammable. If you must use such products, do not dispose of them down the drain. Give away the unused portion to someone who can use the material or ask the municipal government for the location of a safe disposal site or dropoff point.

Switch to less toxic substances. Such old-fashioned cleaners as vinegar and baking soda are still effective and are relatively inert.

We can look for ways to save energy and resources at home. Each litre of water from the tap has to be chlorinated and pumped, and that takes chemicals and energy. Every litre of gasoline burned puts more pollution into the air and reduces non-renewable resources. If your municipality has recycling, use it and push for more materials to be covered in an effort to reach the highest level possible - probably 70 per cent or more of household waste. If there is no recycling program, encourage and help the politicians to start one. Start composting garden and some food wastes in your backyard rather than putting them into the garbage and helping to fill up dumps.

Buy durable goods rather than disposable ones wherever feasible. A high-quality product will likely cost more to buy, but can last for years, even centuries. Each time that disposable or poorly made goods have to be replaced this requires more energy and raw materials.

As public pressure for "environmentally friendly" products mounts, the marketplace is starting to respond. Companies have been rushing to remove chlorofluorocarbons from most aerosol cans and foam plastics, and to produce biodegradable packing. Organic food is starting to appear on more supermarket shelves.

Surveys have shown that four out of five Canadians will pay up to 10 per cent extra for goods that have a low environmental impact.

In the future the challenge will be to expand the list of environmentally friendly products to include the ones that have the lowest total environmental impact. This will include counting the types of materials used in their manufacture, the amount of energy required to make and transport them and the waste products created along the way.

Section 2 - - Control Article

PLEASE READ THE FOLLOWING INFORMATION CAREFULLY. You will be asked questions later about the material in the article. When you have finished reading you may begin the next section of the questionnaire.

Why the Titanic went down like a stone

BY WILLIAM J. BROAD
New York Times Service

A FRESH analysis by maritime experts has concluded that an iceberg wasn't the real reason that the Titanic sank so rapidly. Rather, structural weaknesses in the ship's steel plates caused them to fail with catastrophic consequences.

A better grade of steel, the experts conclude, would have reduced the extensive fracturing and allowed the ship to remain afloat or to flood more slowly, perhaps saving many lives had rescue ships arrived in time.

About 1,500 people died when the Titanic went down in the North Atlantic in 1912 on its maiden voyage.

The analysis is based on physical and photographic clues gathered by five recent expeditions to the shattered hulk of the luxury liner, which lies in waters more than two miles deep. It also draws on a study of the fates of the Titanic's sister ships, the Olympic and the Britannic.

Evidence crucial to the analysis came from steel samples recovered in 1987 and 1991 visits to the wreck and analyzed by the Bedford Institute of Oceanography in Nova Scotia and the French Institute for Maritime Research and Exploration.

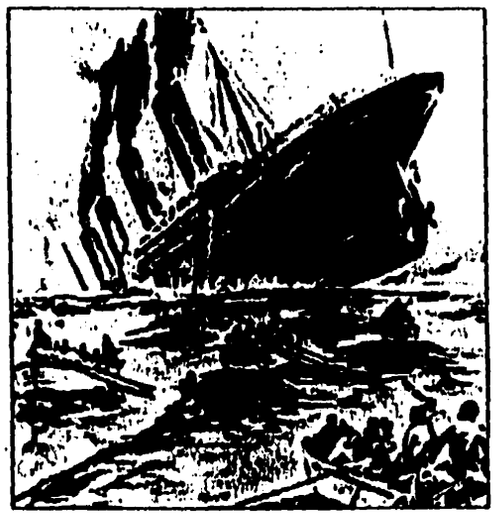
The culprit was found to be a process known as brittle fracture, in which low-grade steel breaks violently when chilled rather than bending. In the case of the Titanic, the hull was cooled to near freezing by the icy Atlantic.

"The problem was the plates being weak rather than the iceberg being strong," says William Garzke, the lead author of the analysis.

"Not all ships of the time were built with brittle plate. But by the standards of the day, it was probably all right" for the ship's owner, the White Star Line, to have used steel that would be scorned today.

Mr. Garzke is a senior naval architect at Gibbs & Cox Inc., a New York firm of naval architects and marine engineers. He and four collaborators from other companies and institutions presented their analysis yesterday at the centennial meeting of the Society of Naval Architects and Marine Engineers in New York City.

"The real tragedy of the Titanic," the team concludes in its paper, is that better construction techniques and "a better quality of steel plate might have averted her loss or resulted in an even slower rate of flooding that may have saved more passengers and crew."



POST MORTEM *New evidence shows that the use of cheap steel may have caused the huge ship to sink far sooner than it should have.*

In a twist, the analysis holds that the rumbles and roars heard by survivors on the night of the sinking were caused not so much by shifting gear and boiler explosions as by the fracturing of huge amounts of brittle steel.

When cooled and stressed, some types of relatively primitive steel fracture much like glass rather than bending or stretching as ductile materials do. Moreover, this type of breakage takes place with a very small expenditure of energy, which can be administered by an external blow or internal stress.

In the process of brittle fracture, a crack that starts in one part of a welded steel hull can pass completely around it, causing a large ship to break in two. In the decades of shipbuilding since the loss of the Titanic, notes Mr. Garzke, "we've learned a lot" about metals and how to make them safer for the extreme conditions at sea.

The sinking of the Titanic is considered one of the great disasters of the century. The liner, considered the latest in engineering and unsinkable, was built by Harland & Wolff of Belfast, Northern Ireland. It was sailing from Southampton, England, to New York when it hit an iceberg while traveling at 22 knots. Two hours and 40 minutes later, at 2:20 a.m. on April 15, the ship sank sank. Only 705 of the passengers survived.

The Globe and Mail September 17, 1993

APPENDIX F. EXPERIMENT TWO - - VALUE BIAS QUESTIONS: IMPORTANCE BIAS, BENEFIT BIAS AND CONTROL WTP QUESTIONS

Section 5 - Importance Bias

There are 24 questions in this section. For the next 12 questions indicate the **importance to you** of each good. Please circle the number that corresponds to your answer. If you have any questions, raise your hand and a monitor will help you.

1) How important to you are yearly Medicare-funded dental examinations (including teeth cleaning) for all individuals?

unimportant 0 1 2 3 4 5 6 7 8 9 10 *very important*

2) How important to you is a three-credit course at McGill University?

unimportant 0 1 2 3 4 5 6 7 8 9 10 *very important*

3) How important to you is a $35.00 pass for unlimited entries into the Biodôme de Montréal for one year?

unimportant 0 1 2 3 4 5 6 7 8 9 10 *very important*

4) How important to you is a two-year educational program on health risks associated with smoking cigarettes and drinking alcohol?

unimportant 0 1 2 3 4 5 6 7 8 9 10 *very important*

5) How important to you is a substantial improvement in the water quality of the St. Lawrence River over the next five years?

unimportant 0 1 2 3 4 5 6 7 8 9 10 *very important*

6) How important to you is a three-year program of shelters for homeless youth in urban centers throughout Canada?

unimportant 0 1 2 3 4 5 6 7 8 9 10 *very important*

7) How important to you is a permanent program for the conservation of old-growth forests in British Columbia?

unimportant 0 1 2 3 4 5 6 7 8 9 10 *very important*

8) How important to you is a Walkman portable cassette player?

unimportant 0 1 2 3 4 5 6 7 8 9 10 *very important*

9) How important to you is a three-day canoe trip led by Algonquin guides on the Harricana River in the Abitibi region of northern Quebec?

unimportant 0 1 2 3 4 5 6 7 8 9 10 *very important*

10) How important to you is a permanent program for the protection of the forested greenspace on Mount Royal in Montreal?

unimportant 0 1 2 3 4 5 6 7 8 9 10 *very important*

11) How important to you is a half-day cruise from Tadoussac, Quebec to see the beluga whales in the St. Lawrence River?

unimportant 0 1 2 3 4 5 6 7 8 9 10 *very important*

12) How important to you is a 4-litre container of #1 clear Quebec maple syrup?

unimportant 0 1 2 3 4 5 6 7 8 9 10 *very important*

Section 5 - Benefit Bias

There are 24 questions in this section. For the next 12 questions indicate how much you benefit from each good. Please circle the number that corresponds to your answer. If you have any questions, raise your hand and a monitor will help you.

1) How much do you benefit from yearly Medicare-funded dental examinations (including teeth cleaning) for all individuals?

no benefit 0 1 2 3 4 5 6 7 8 9 10 *high benefit*

2) How much do you benefit from a three-credit course at McGill University?

no benefit 0 1 2 3 4 5 6 7 8 9 10 *high benefit*

3) How much do you benefit from a $35.00 pass for unlimited entries into the Biodôme de Montréal for one year?

no benefit 0 1 2 3 4 5 6 7 8 9 10 *high benefit*

4) How much do you benefit from a two-year educational program on health risks associated with smoking cigarettes and drinking alcohol?

no benefit 0 1 2 3 4 5 6 7 8 9 10 *high benefit*

5) How much do you benefit from a substantial improvement in the water quality of the St. Lawrence River over the next five years?

no benefit 0 1 2 3 4 5 6 7 8 9 10 *high benefit*

6) How much do you benefit from a three-year program of shelters for homeless youth in urban centers throughout Canada?

no benefit 0 1 2 3 4 5 6 7 8 9 10 *high benefit*

7) How much do you benefit from a permanent program for the conservation of old-growth forests in British Columbia?

no benefit 0 1 2 3 4 5 6 7 8 9 10 *high benefit*

8) How much do you benefit from a Walkman portable cassette player?

no benefit 0 1 2 3 4 5 6 7 8 9 10 *high benefit*

9) How much do you benefit from a three-day canoe trip led by Algonquin guides on the Harricana River in the Abitibi region of northern Quebec?

no benefit 0 1 2 3 4 5 6 7 8 9 10 *high benefit*

10) How much do you benefit from a permanent program for the protection of the forested greenspace on Mount Royal in Montreal?

no benefit 0 1 2 3 4 5 6 7 8 9 10 *high benefit*

11) How much do you benefit from a half-day cruise from Tadoussac, Quebec to see the beluga whales in the St. Lawrence River?

no benefit 0 1 2 3 4 5 6 7 8 9 10 *high benefit*

12) How much do you benefit from a 4-litre container of #1 clear Quebec maple syrup?

no benefit 0 1 2 3 4 5 6 7 8 9 10 *high benefit*

Section 5 - Control WTP Questions

On the following pages are listed 12 items or activities. These items differ in two ways. First, some items (e.g., a cup of coffee) are usually enjoyed individually, whereas others (e.g., a park) are usually shared. Second, some items are commonly available for purchase, whereas others are not. However, just as you can use money to purchase bread or textbooks, you also could use money to fund a project that is not usually sold in a store, such as recreational facilities.

We would like you to tell us THE MAXIMUM YOU WOULD BE WILLING TO PAY (IN DOLLARS) FOR EACH OF THE FOLLOWING 12 ITEMS.

To do this, evaluate each item individually. Read each question and determine the maximum amount you would pay to include this item in your current budget. **Answer the question as though you would actually pay for the item.**

If the item can also be used by other people, assume that everyone in Canada would pay an equal amount. For these "shared" goods, indicate the ANNUAL amount you would be willing to pay for the item during its specified time frame.

Take as much time as you need to complete the task carefully. If you have any questions, raise your hand and a monitor will help you.

What is the ANNUAL INCOME you will use to answer the following questions?

$ _____

1) What is the maximum you are willing to pay for yearly Medicare-funded dental examinations (including teeth cleaning) for all individuals?

$_____

2) What is the maximum you are willing to pay for a three-credit course at McGill University?

$_____

3) What is the maximum you are willing to pay for a $35.00 pass for unlimited entries into the Biodôme de Montréal for one year?

$_____

4) What is the maximum you are willing to pay for a two-year educational program on health risks associated with smoking cigarettes and drinking alcohol?

$_____

5) What is the maximum you are willing to pay for a substantial improvement in the water quality of the St. Lawrence River over the next five years?

$_____

6) What is the maximum you are willing to pay for a three-year program of shelters for homeless youth in urban centers throughout Canada?

$_____

7) What is the maximum you are willing to pay for a permanent program for the conservation of old-growth forests in British Columbia?

$_____

8) What is the maximum you are willing to pay for a Walkman portable cassette player?

$_____

9) What is the maximum you are willing to pay for a three-day canoe trip led by Algonquin guides on the Harricana River in the Abitibi region of northern Quebec?

$_____

10) What is the maximum you are willing to pay for a permanent program for the protection of the forested greenspace on Mount Royal in Montreal?

$_____

11) What is the maximum you are willing to pay for a half-day cruise from Tadoussac, Quebec to see the beluga whales in the St. Lawrence River?

$_____

12) What is the maximum you are willing to pay for a 4-litre container of #1 clear Quebec maple syrup?

$_____

APPENDIX G. EXPERIMENT TWO - - NONSIGNIFICANT RESULTS

TABLE G.1. ANOVA Table For The Effects Of Bias On WTP For Twelve Goods

DEPENDENT VARIABLE	ANOVA MODEL INDEPENDENT EFFECTS					
	Information (I) 1 d.f.		Value Bias (V) 2 d.f.		I x V Interaction 2 d.f.	
	F Value	Pr > F	F Value	Pr > F	F Value	Pr > F
Public Nonenvironmental Goods: Dental Care	0.07	(n.s.) 0.7852	7.86	* 0.0006	1.52	(n.s.) 0.2222
Educational Program	9.77	* 0.0022	3.36	* 0.0378	0.56	(n.s.) 0.5718
Youth Homeless Shelters	1.03	(n.s.) 0.3126	8.51	* 0.0003	0.40	(n.s.) 0.6739
Public Environmental Goods: St. Lawrence River Clean-up	7.18	* 0.0084	5.22	* 0.0066	1.97	(n.s.) 0.1437
Protection of B.C. Forests	0.08	(n.s.) 0.7793	2.92	(n.s.) 0.0578	0.67	(n.s.) 0.5112
Protection of Montreal Greenspace	0.90	(n.s.) 0.3436	1.99	(n.s.) 0.1410	1.18	(n.s.) 0.3117
Private Nonenvironmental Goods: McGill University Tuition	2.75	(n.s.) 0.0992	0.84	(n.s.) 0.4351	0.44	(n.s.) 0.6430
Portable Walkman	0.01	(n.s.) 0.9357	5.74	* 0.0040	1.00	(n.s.) 0.3716
Maple Syrup	1.94	(n.s.) 0.1656	0.79	(n.s.) 0.4537	0.59	(n.s.) 0.5555
Private Environmental Goods: Montreal Biodome Annual Pass	0.12	(n.s.) 0.7301	4.13	* 0.0179	0.19	(n.s.) 0.8248
Canoe Trip	0.18	(n.s.) 0.6737	2.04	(n.s.) 0.1340	1.27	(n.s.) 0.2825
Whale Watching Trip	0.66	(n.s.) 0.4163	0.97	(n.s.) 0.3801	0.42	(n.s.) 0.6566

* significant at the 5% level; (n.s.) not significant at the 5% level.

TABLE G.2. The ANOVA Table For Effects Of Bias On Six Attribute Scores For Twelve Goods

DEPENDENT VARIABLE	ANOVA MODEL INDEPENDENT EFFECTS					
	Information (I) 1 d.f.		Value Bias (V) 2 d.f.		I x V Interaction 2 d.f.	
	F Value	Pr > F	F Value	Pr > F	F Value	Pr > F
Dental Care: Canadian Societal Importance	0.83	0.3628	0.48	0.6224	1.82	0.1659
Scarcity	0.11	0.7444	1.08	0.3430	0.08	0.9193
Duration of Benefits	3.54	0.0621	3.33	0.0385	1.12	0.3303
Importance to Québec	2.05	0.1542	0.11	0.8955	0.57	0.5641
Value Precision	1.88	0.1722	0.22	0.8022	0.63	0.5319
Environmental Impact	0.45	0.5042	1.47	0.2327	0.24	0.7869
Educational Program: Canadian Societal Importance	0.38	0.5372	2.16	0.1192	1.23	0.2949
Scarcity	0.09	0.7619	0.26	0.7750	0.51	0.6009
Duration of Benefits	0.44	0.5093	0.21	0.8103	1.59	0.2071
Importance to Québec	0.64	0.4266	3.03	0.0518	1.73	0.1821
Value Precision	3.12	0.0795	0.07	0.9346	0.26	0.7701
Environmental Impact	0.01	0.9176	0.33	0.7186	0.83	0.4401
Youth Homeless Shelters: Canadian Societal Importance	0.05	0.8304	0.27	0.7625	1.07	0.3475
Scarcity	0.50	0.4798	0.82	0.4426	0.24	0.7906
Duration of Benefits	0.22	0.6361	0.66	0.5177	0.76	0.4689
Importance to Québec	0.10	0.7495	0.19	0.8261	0.79	0.4551
Value Precision	1.22	0.2712	0.59	0.5560	1.78	0.1733
Environmental Impact	0.04	0.8352	0.21	0.8115	0.15	0.8595

TABLE G2. (CONTINUED)

DEPENDENT VARIABLE	ANOVA MODEL INDEPENDENT EFFECTS					
	Information (I) 1 d.f.		Value Bias (V) 2 d.f.		I x V Interaction 2 d.f.	
	F Value	Pr > F	F Value	Pr > F	F Value	Pr > F
St. Lawrence River Clean-up: Canadian Societal Importance	10.75	0.0013	0.07	0.9360	0.21	0.8133
Scarcity	0.71	0.4023	0.35	0.7048	0.58	0.5619
Duration of Benefits	0.69	0.4089	1.75	0.1779	0.17	0.8405
Importance to Québec	5.31	0.0228	0.62	0.5419	0.02	0.9823
Value Precision	4.05	0.0463	0.01	0.9896	1.45	0.2378
Environmental Impact	1.88	0.1730	0.36	0.6997	0.35	0.7048
Protection of B. C. Forests: Canadian Societal Importance	2.29	0.1326	0.10	0.9015	1.32	0.2697
Scarcity	0.91	0.3431	1.75	0.1778	0.27	0.7650
Duration of Benefits	1.10	0.2972	0.34	0.7123	0.57	0.5695
Importance to Québec	0.58	0.4491	1.29	0.2789	0.81	0.4466
Value Precision	0.01	0.9116	0.11	0.8994	0.15	0.8591
Environmental Impact	0.16	0.6896	0.62	0.5371	0.51	0.6034
Protection of Montreal Greenspace: Canadian Societal Importance	1.26	0.2629	0.41	0.6670	0.42	0.6563
Scarcity	1.45	0.2311	0.25	0.7785	1.25	0.2902
Duration of Benefits	0.64	0.4240	0.40	0.6718	0.25	0.7808
Importance to Québec	0.03	0.8562	0.00	0.9970	0.72	0.4884
Value Precision	0.06	0.8051	0.54	0.5822	0.36	0.6962
Environmental Impact	0.07	0.7975	0.96	0.3852	1.79	0.1705

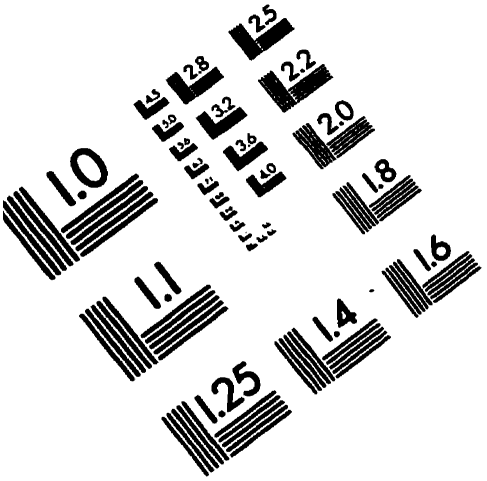
TABLE G2. (CONTINUED)

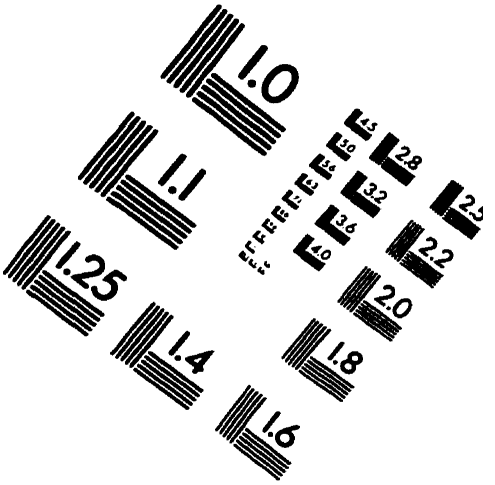
DEPENDENT VARIABLE	ANOVA MODEL INDEPENDENT EFFECTS					
	Information (I) 1 d.f.		Value Bias (V) 2 d.f.		I x V Interaction 2 d.f.	
	F Value	Pr > F	F Value	Pr > F	F Value	Pr > F
McGill University Tuition: Canadian Societal Importance	0.90	0.3456	0.70	0.4963	1.29	0.2792
Scarcity	1.79	0.1832	1.40	0.2490	0.02	0.9802
Duration of Benefits	0.17	0.6826	0.14	0.8671	2.40	0.0941
Importance to Québec	0.33	0.5655	0.39	0.6767	1.30	0.2765
Value Precision	0.00	0.9726	3.58	0.0302	2.85	0.0612
Environmental Impact	0.04	0.8510	2.46	0.0884	1.08	0.3426
Portable Walkman: Canadian Societal Importance	1.47	0.2267	1.63	0.1991	1.13	0.3260
Scarcity	6.53	0.0116	1.20	0.3053	0.31	0.7370
Duration of Benefits	0.00	0.9736	0.10	0.9068	0.47	0.6284
Importance to Québec	3.07	0.0820	2.93	0.0567	0.62	0.5379
Value Precision	1.16	0.2827	1.85	0.1609	0.56	0.5734
Environmental Impact	1.46	0.2293	0.93	0.3973	0.05	0.9524
Maple Syrup: Canadian Societal Importance	0.99	0.3213	1.73	0.1813	0.71	0.4910
Scarcity	0.02	0.8776	0.02	0.9796	0.47	0.6240
Duration of Benefits	0.07	0.7933	0.82	0.4410	0.53	0.5918
Importance to Québec	3.86	0.0513	1.98	0.1415	1.40	0.2494
Value Precision	1.03	0.3119	0.07	0.9325	0.29	0.7520
Environmental Impact	1.60	0.2076	0.49	0.6112	0.74	0.4767

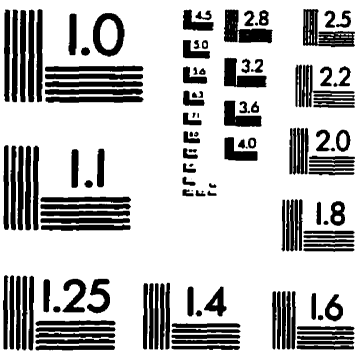
TABLE G2. (CONTINUED)

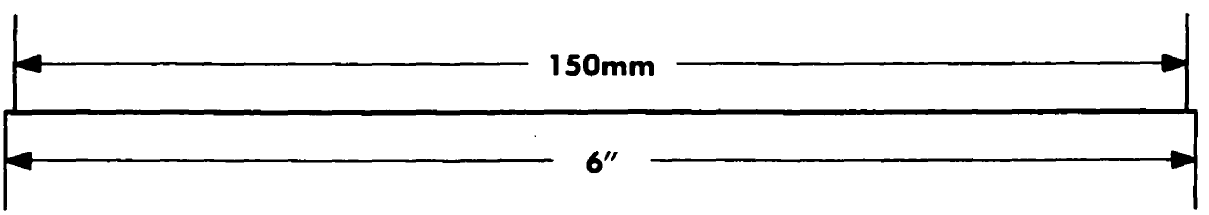
DEPENDENT VARIABLE	ANOVA MODEL INDEPENDENT EFFECTS					
	Information (I) 1 d.f.		Value Bias (V) 2 d.f.		I x V Interaction 2 d.f.	
	F Value	Pr > F	F Value	Pr > F	F Value	Pr > F
Montreal Biodome Annual Pass: Canadian Societal Importance	2.49	0.1166	0.67	0.5142	0.55	0.5802
Scarcity	0.27	0.6052	1.33	0.2683	0.12	0.8912
Duration of Benefits	0.03	0.8736	0.05	0.9542	1.28	0.2817
Importance to Québec	1.03	0.3126	0.85	0.4283	1.17	0.3134
Value Precision	1.37	0.2428	0.18	0.8376	0.04	0.9586
Environmental Impact	0.03	0.8584	1.45	0.2372	0.47	0.6237
Canoe Trip: Canadian Societal Importance	0.09	0.7643	1.01	0.3677	0.49	0.6162
Scarcity	3.18	0.0766	0.05	0.9520	0.35	0.7032
Duration of Benefits	0.50	0.4817	0.33	0.7164	2.20	0.1148
Importance to Québec	1.46	0.2293	1.54	0.2172	0.57	0.5659
Value Precision	0.33	0.5646	1.36	0.2599	0.04	0.9620
Environmental Impact	0.93	0.3362	0.29	0.7460	2.20	0.1147
Whale Watching Trip: Canadian Societal Importance	0.83	0.3633	0.05	0.9508	0.72	0.4895
Scarcity	0.23	0.6325	0.36	0.6968	0.06	0.9461
Duration of Benefits	0.01	0.9091	0.01	0.9867	0.18	0.8375
Importance to Québec	0.35	0.5548	0.24	0.7842	0.00	0.9998
Value Precision	0.32	0.5703	0.01	0.9916	0.50	0.6097
Environmental Impact	0.07	0.7924	0.47	0.6249	1.81	0.1667

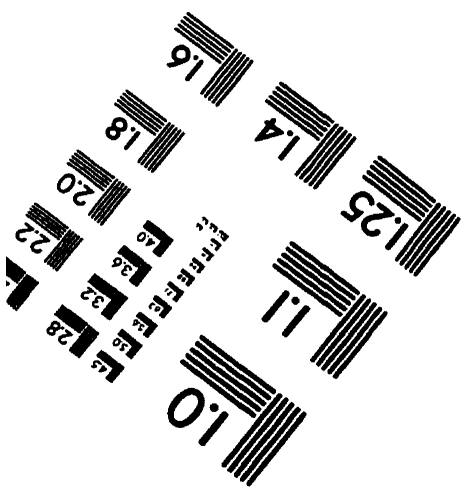
IMAGE EVALUATION TEST TARGET (QA-3)

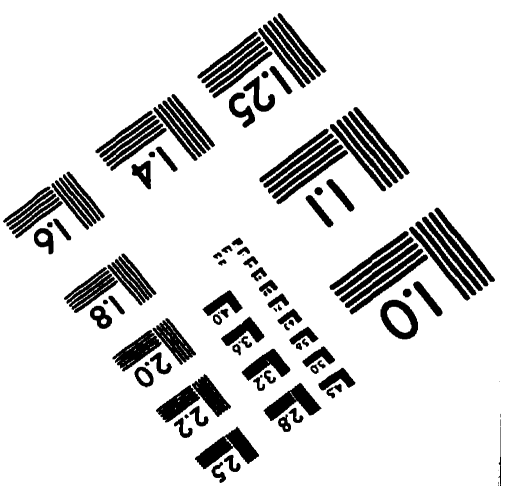












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