

# CONTINGENT VALUATION: USING SURVEYS TO ELICIT INFORMATION ABOUT COSTS AND BENEFITS

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EE465/EE463 Project Evaluation  
Semester 2/2015

# Topics

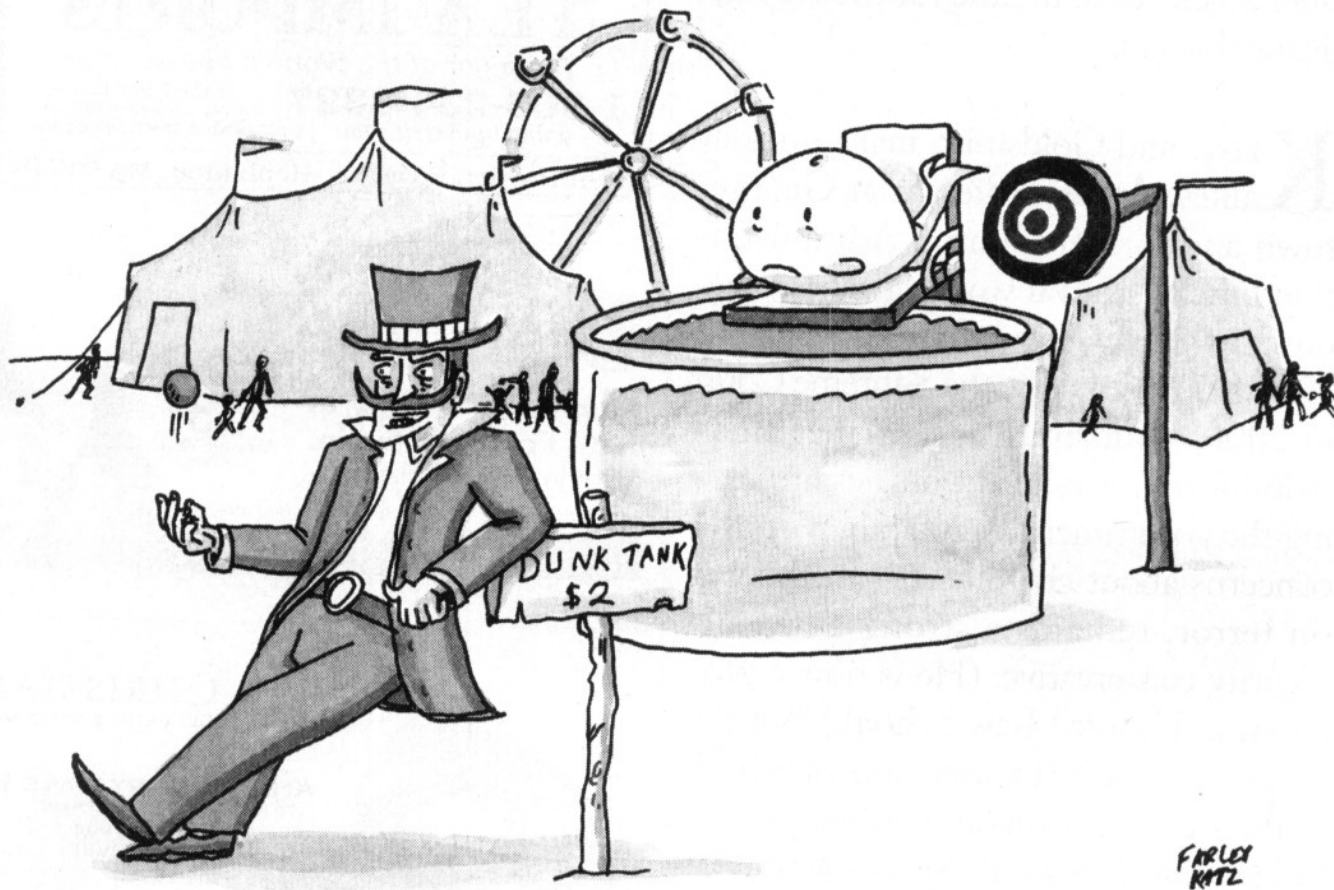
- Overview of CV methods
- Payment vehicle
- Generic survey issues
- Contingent valuation problems and issues
- Accuracy of CV
- Heuristics for the design and use of CV surveys

# OVERVIEW OF CV METHODS (1)

- For some public goods, there are no obvious ways to determine preferences through observation of behaviors.
- In these cases, there may be no alternative to **asking a sample of people questions about their valuations**. These surveys are called **contingent valuation (CV) surveys**.
- The primary use of CV is to elicit people's **Willingness to Pay (WTP)** for changes in the quantity of a good.
- It circumvents the absence of markets for environmental goods and service by presenting consumers **with hypothetical markets** in which they have the opportunity to pay or accept compensation for the good or service in question.

# OVERVIEW OF CV METHODS (2)

- CVM is referred to as a **“stated preference” method**, because it asks people to ***directly state their values***, rather than inferring values from actual choices, as the “revealed preference” methods do.
- It is called **“contingent” valuation**, because people are asked to state their WTP or WTA, *contingent* on a specific hypothetical scenario and description of the environmental good or service.
- Valuing “use” or “potential use” goods with CV is relatively non-controversial. Valuing *passive use* (nonuse) goods with CV is more controversial.
  - Example: estimating passive use values in natural resource damage assessment cases.



*"Step right up and save a baby whale's life."*

# OVERVIEW OF CV METHODS (3)

- Steps in conducting CV:
  1. Identify a sample of respondents from the population.
  2. Ask respondents questions about their valuations of a good.
  3. Estimate respondents' WTP for the good using information from the survey.
  4. Extrapolate the results to the entire population.
  
- Two groups of CV methods:
  1. Direct elicitation (non-referendum) methods
  2. The dichotomous-choice (referendum) method

# Direct Elicitation (Non-Referendum) Methods (1)

## 1. Open-Ended WTP Method:

- Respondents are simply asked to state their maximum WTP for a good or policy being valued.
- Possible question: “What is the most that you would be prepared to pay in additional income taxes to guarantee that there is a restriction on the number of tourists entering the Ta Chai Island each day?”
- Issues: Analysts feared unrealistic responses because respondents needed some initial guidance on valuations.

# Direct Elicitation Methods (2)

## 2. Close-Ended Iterative Bidding Method:

- Respondents are asked if they would pay a specified amount for the good or policy.
  - If yes, then the amount is increased incrementally and they are asked again (until there is a response of no).
  - If no, then the amount is lowered and they are asked again (until there is a response of yes).
- This method was once widely used, but it is not anymore because results were found to be too sensitive to the initially presented, or starting, value.

# Example: Iterative Bidding Method

## Frequency Distribution for Estimated Willingness-to-Pay for Water Pollution Control in Norway

Final bid (NOK)	Total sample (percent)	Initial Starting Point	
		100NOK	200NOK
50	11.2	11.6	10.9
80	0.2	0.0	0.4
90	0.2	0.4	0.0
100	21.7	28.2	14.5
200	31.2	27.8	35.1
400	19.0	17.0	21.4
800	8.2	7.2	9.3
1,500	6.1	6.1	6.0
2,100	0.2	0.4	0.0
5,000	1.9	1.4	2.4
X WTP (NOK)	422.51	387.33	461.82
$\sigma$	32.13	40.50	50.78

Kolmogorov-Smirnov statistics = 1.62.  
 $p < .01$   $\alpha$  level.

Source: Regens, J. L. (1991). Measuring environmental benefits with contingent markets. *Public Administration Review*, 345-352.

# Direct Elicitation Methods (3)

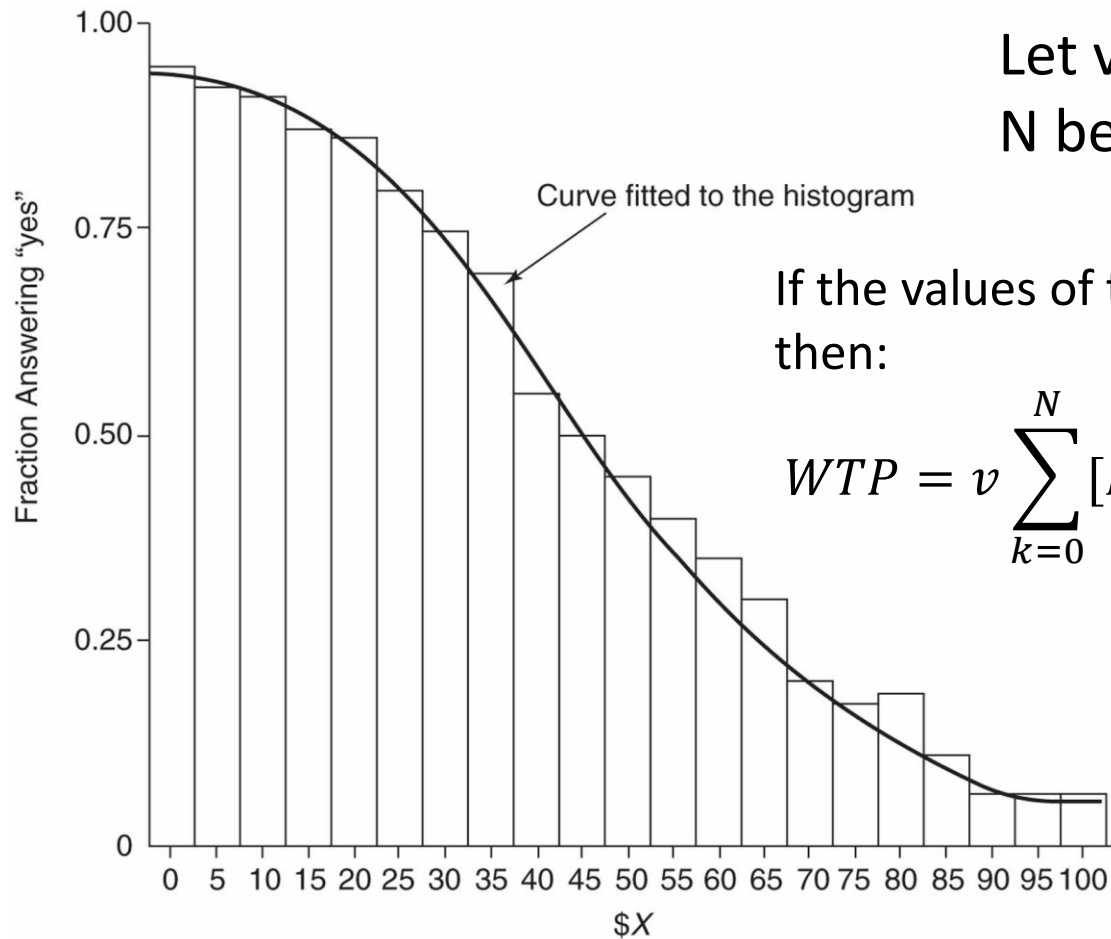
## 3. Contingent Ranking Method:

- Respondents are asked to rank specific feasible combinations of the good being valued and monetary payments.
- Example: Low water quality and low taxes vs. high quality and high taxes, including several combinations in between.
- The rankings provide a basis for estimating each respondent's WTP for various increments of quality.
- Contingent ranking implies an *ordinal ranking procedure* in contrast to *cardinal evaluation* in the iterative bidding procedure.
- The WTP must be inferred from the rankings, however, rather than being directly elicited. Issues?

# The Dichotomous-Choice (Referendum) Method

- Respondents are asked whether they would be willing to pay a particular amount, or **bid price**, to obtain a good or policy.
  - The range of dollar amounts are chosen by the analyst.
  - Because many respondents are surveyed, accept/reject probabilities can then be calculated for each bid price.
  - Data can then be plotted in a histogram (number of yes responses versus bid price).
  - The curve fitted to the histogram can be viewed as the *demand curve* of a randomly drawn member of the sample.
  - The area under this curve provides an estimate of the individual's WTP.

# Histogram of Dichotomous Choice Responses



Let  $v$  be the spacing interval &  $N$  be the number of price values.

If the values of the bid prices are evenly spaced, then:

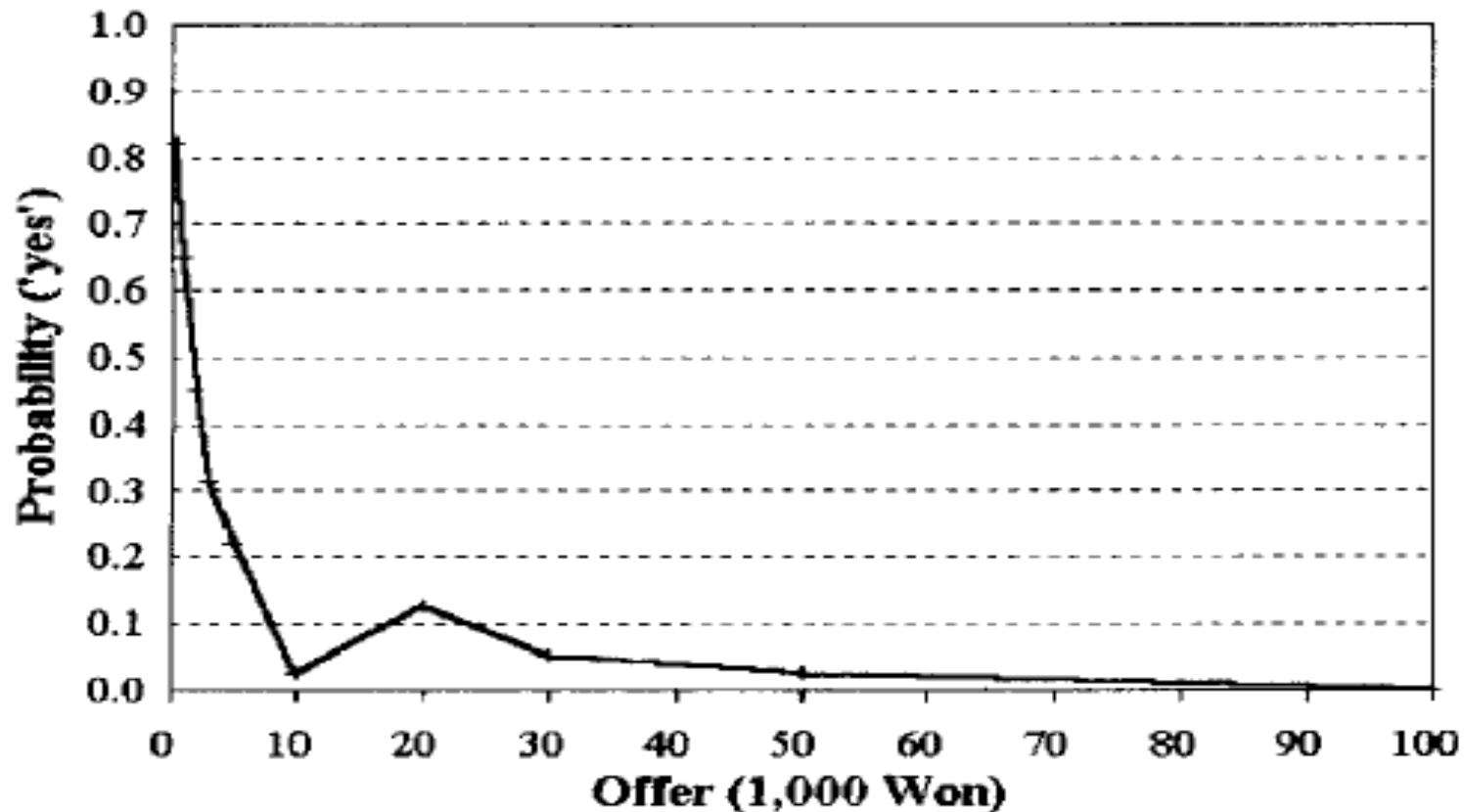
$$WTP = v \sum_{k=0}^N [Prob\ of\ acceptance\ at\ price\ kv]$$

# The Dichotomous Choice Method (Cont'd)

- In practice, analysts use a statistical model to estimate a **probability of acceptance curve** for each identified group within the sample. Hence, one can estimate a WTP for each group.
  - To find the aggregate WTP for the entire population, multiply the mean for each group by the size of the group in the population (with standing) and then sum across all of the groups.
- Large sample size is needed.
- *Double-dichotomous-choice* questions are sometimes used to reduce the need for large samples. Depending on the answer to the first offer, a follow up is asked (double if “yes”; half if “no”).

# Example: Dichotomous Choice Method

Probability of "Yes" Answer under Hypothetical Scenario



Source: Lee, C. K. (1997). Valuation of nature-based tourism resources using dichotomous choice contingent valuation method. *Tourism Management*, 18(8), 587-591

# PAYMENT VEHICLE

- Payment vehicles are descriptions of how the costs of providing the good will be paid.
  - Examples: taxes paid into a fund specifically earmarked for the good, increased utility bills, higher income taxes, higher product prices.
- Payment vehicles are usually included in CV surveys to help respondents perceive the questions as real economic choices.
- The choice of vehicle can make a difference in the estimated WTP.
  - Example: Respondents appeared to value watershed management plans different depending on whether the taxes were earmarked for this management plan.
- There is an issue as to whether this should be treated as a bias.

# GENERIC SURVEY ISSUES:

## Survey Administration (1)

- **In person:**
  - Provides complex information and allows interviewer to clarify questions and use visual aids.
  - There is a high risk of *interviewer bias* .
  - Very expensive and can sometimes be difficult to obtain a random sample.
- **Telephone:**
  - This is the most common method, and has much lower costs than the in-person method, and has a better chance of obtaining a random sample through random digit dialing.
  - Information is limited to verbal communication, but interviewer bias is still possible (voice cues).
  - The prevalence of telemarketing may be causing more people to refuse to participate in phone surveys
  - Cell phones make it more difficult to sample geographically.

# GENERIC SURVEY ISSUES:

## Survey Administration (2)

- **Mail:**

- This is low cost and allows the presentation of visual aids, but one needs a good address list to get a random sample.
- Response rates are low. There is no chance of interviewer bias.

- **Internet:**

- This is very low cost, has no interviewer bias, and allows presentation of complex information.
- Yet, it is not possible to draw random samples; spamming restrictions prevent random mailing.
- Firms are beginning to develop databases of willing respondents, which may eventually allow for random selection.

# Survey Administration Alternatives

	<i>Cost per Completed Interview</i>	<i>Ease of Identifying and Reaching Respondents</i>	<i>Risk of Interviewer Bias</i>	<i>Maximum Complexity of Provided Information</i>
<b><i>In-Person</i></b>	Very high—depends on questionnaire length and geographic spread	Medium—depends on availability of lists and access	High—personal presence, monitoring difficult	Very high—interactive communication and visual aids possible
<b><i>Telephone</i></b>	High—depends on questionnaire length and callbacks	Very high—random digit dialing	Medium—interviewer cues	Low—verbal communication limits complexity of content
<b><i>Mail</i></b>	Low—depends on number of follow-ups	High—depends on availability of appropriate lists	Low—uniform presentation	High—visual aids possible
<b><i>Internet</i></b>	Low—marginal costs very small	Low—“spamming” restrictions require panels of willing respondents	Low—uniform presentation	Very high—visual aids and interactive questions possible

# GENERIC SURVEY ISSUES:

## Sample and Non-Sample Biases

- **Sample design** answers how to identify individuals to be sampled from target populations.
  - In a random sample, each individual has a known probability of being drawn from the population.
  - In a simple random sample, everyone has the same probability of being sampled.
  - In a stratified (random) sample, particular groups have different probabilities of being sampled (each individual has the same percentage chance as the others in the same group).
- For CV purposes, the relevant target population is usually *all individuals with standing who are affected by the policy*.

## Issues involved in addressing who is “affected”

- All “*users*” *directly affected* by the project—those who use it, those who suffer negative impacts from it, and those who are passive users.
- It is important for respondents to understand whether they are being asked to estimate WTP for just themselves or as representatives for their whole households.
- An explicit decision must be made about the *inclusion of passive use benefits*. Conceptually, they should be included but there is disagreement on the validity of using CV surveys to estimate them.
- The geographic *spread* of the sample should be wide enough to capture all affected individuals.

# CV PROBLEMS AND ISSUES

1. Hypotheticality, Meaning and Context Problems
2. Neutrality
3. Decision Making and Judgment Biases
4. WTP versus WTA
5. The Strategic Response (Honesty) Problem

# 1. Hypotheticality, Meaning and Context Problems

- A major concern is **whether respondents are truly able to understand the questions they are being asked** and hence, **whether they can accurately value the good in question.**
  - Problems arise in defining exactly what is the good or policy in question.
  - If perception of the good is not independent of the quality or quantity of information provided, then the results can be biased.
- The problems of hypothetical scenarios can be reduced by:
  - Specifying the project and its impacts clearly
  - Providing explicit detail about the payment vehicle
  - Using visual aids such as photographs, maps, diagrams to assist understanding

# Illustration: A Water Quality Ladder

## EXHIBIT 15-2

A “water quality ladder” has been used in several CBAs to help respondents understand how differing levels of toxins, dissolved solids, water clarity, and other factors affect water quality. In their CBA of water quality improvements to the Monongahela River, V. Kerry Smith and William Desvousges included a picture of a ladder with a 0-to-10 scale and the following interviewer instructions:

“(Interviewer: Read the following.) Generally the better the water quality the better suited the water is for recreation activities and the more likely people will take part in outdoor recreation activities on or near the water. Here is a picture of a ladder that shows various levels of water quality. (Interviewer: Give respondent water quality ladder.)

The top of the ladder stands for the best possible quality of water. The bottom of the ladder stands for the worst possible water quality. On the ladder you can see the different levels of the

quality of the water. For example: (Interviewer: Point to each level—E, D, C, B, A—as you read the statements that follow).

Level E (Interviewer: Point.) is so polluted that it has oil, raw sewage, and other things like trash in it; it has no plant or animal life and smells bad.

Water at level D is okay for boating but not fishing or swimming.

Level C shows where the water is clean enough so that game fish like bass can live in it.

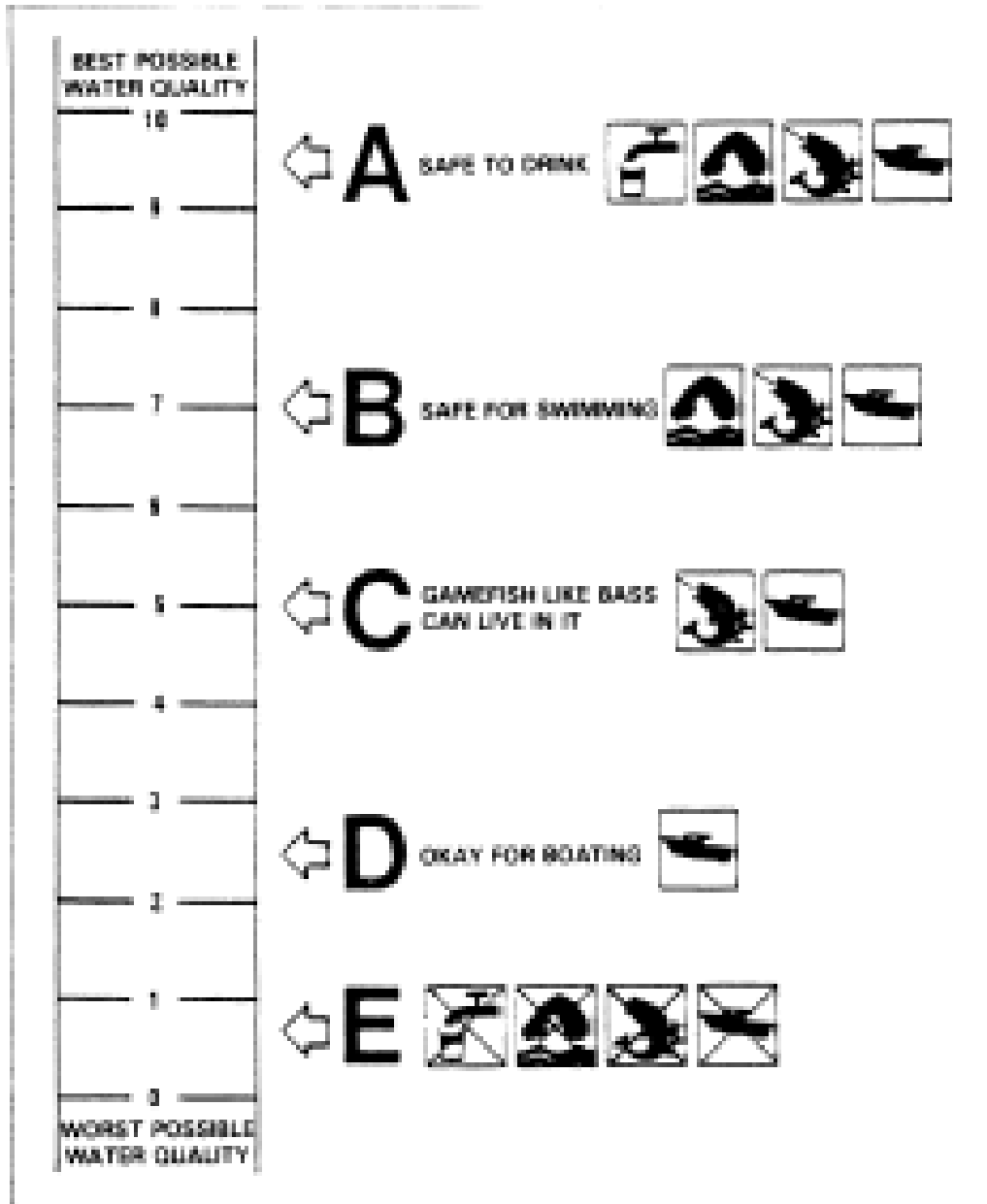
Level B shows where the water is clean enough so that people can swim in it safely.

And at level A, the quality of the water is so good that it would be possible to drink directly from it if you wanted to.

(Interviewer: Now ask the respondent to use the ladder to rate the water quality in the Monongahela River on a scale of 0 to 10 and to indicate whether the ranking was for a particular site, and if so, to name it.)”

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Source: Adapted from V. Kerry Smith and William H. Desvousges, *Measuring Water Quality Benefits* (Boston, MA: Kluwer Academic, 1986), 87.



# Water Quality Ladder

Source: Smith, V. K., Desvousges, W. H., & Fisher, A. (1986). A comparison of direct and indirect methods for estimating environmental benefits. *American Journal of Agricultural Economics*, 68(2), 280-290.

## 2. Neutrality

- A problem arises if questions are not phrased accurately to elicit a neutral response.
- Beware of advocacy groups or those with an interest (litigants).

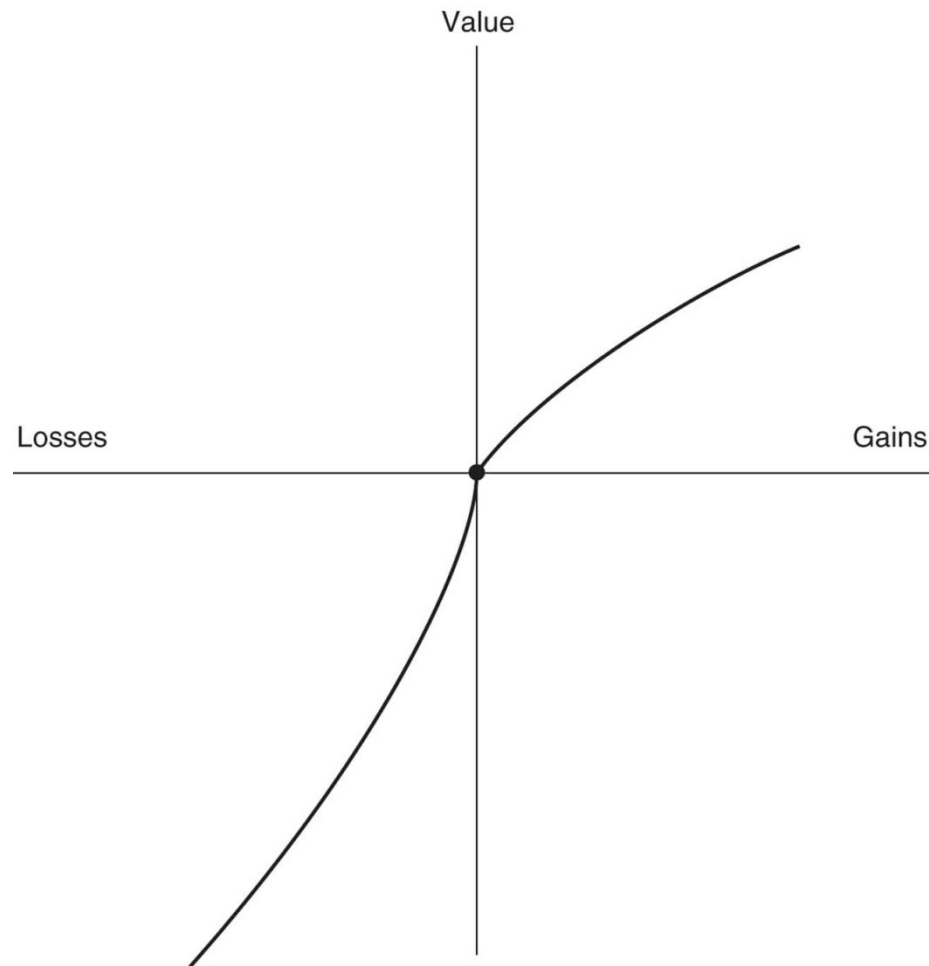
Example: In a study on valuation of preserving the spotted owl, some information (e.g. ...concluded that logging should be banned ...to prevent the extinction of the Northern Spotted Owl).

- *Neutrality can best be ensured by pre-testing the survey instruments with substantive experts who have “no axe to grind” in terms of the specific project that is being considered.*
- If there’s no neutral experts, then pre-testing with opposing advocates can be an alternative.

### 3. Decision Making and Judgment Biases

- In the context of CV, **judgement bias** rather than **decision-making bias** is more applicable because the respondent is not actually purchasing the good in question.
- Examples of judgement biases faced by individuals: *availability bias, representativeness, optimism bias, anchoring bias, hindsight bias, status quo bias*.
- The violations of the expected utility hypothesis (i.e. non-utility-maximizing) can be explained by **prospect theory**:
  - Individuals value gain and losses from a reference point rather than valuing net wealth.
  - People are risk averse toward gains and risk seeking toward losses. → “Loss Aversion”

# A “Loss Aversion” Value Function



## 4. WTP vs. WTA

- Willingness to pay (WTP) is the maximum amount of money an individual would *give up in exchange for all the benefits* associated with a good.
  - The area under an individual's demand curve (An individual would be willing to pay an amount equal to the total benefits received from the environmental good).
- Willingness to accept (WTA) is the minimum total amount of money an individual would *accept to forego all the benefits* associated with a good.
  - It is the opposite of WTP in terms of resource allocation or property rights.

WTP < = > WTA?

# WTP versus WTA

- If people behave rationally and markets are efficient, then for most goods it should make little difference if the person is asked about WTP or WTA.
- However, individuals demand greater dollar compensation to give up things they already possess than they are willing to pay to acquire the exact same item.
- Evidence shows WTA amounts 4 to 15 times WTP amounts (possibly due to loss aversion).
- WTA and WTP valuations get closer as respondents gain experience in evaluating the question.
- WTP question formats, rather than WTA formats, should be used in CV in almost all cases.

## 5. The Strategic Response (Honesty) Problem

- It's argued that respondents in CV surveys have incentives to behave *strategically*; i.e., to misrepresent their true preference in order to achieve more desirable outcomes.
- The open-ended WTP method and contingent ranking methods are more vulnerable to strategic responses.
- It is important to reduce the strategic response bias:
  - The survey needs to be perceived as *consequential* (i.e. it could potentially influence some outcomes).
  - For the dichotomous choice method, the mechanisms use to design CV surveys should be *incentive compatible* (i.e. it provides incentives for individuals to reveal their preferences truthfully).

# Incentive Properties of Dichotomous Choice Questions Applied to Types of Goods

<i>Type of Good</i>	<i>Incentive Property</i>
New public good with coercive payment	Incentive compatible
New public good with voluntary payment	Not incentive compatible
Introduction of new private good	Not incentive compatible
Choice between two new public goods	Incentive compatible
Choice between an existing and an alternative private good	Incentive compatible, but choice does not reveal information about quantity demanded

*Source:* Adapted from Richard T. Carson and Theodore Groves, “Incentive and Informational Properties of Preference Questions,” *Environmental and Resource Economics* 37(1) 2007, p. 192.

# HOW ACCURATE IS CV?

- Accuracy can be assessed in the following ways:
  - First, compare CV values to those generated by other methods; determine if results appear similar to travel costs studies, hedonic price regressions, and market prices of substitutes analyses.
  - Second, compare respondents' CV statements and their actual behavior (from an experiment on the good in question).
  - Third, complete comparisons of CV values over time.
- In general, CV seems valid in use contexts, but its use in estimating non-use values is still subject to biases, such as ordering bias, embedding bias, noncommitment bias, etc.

# HEURISTICS FOR THE DESIGN AND USE OF CV SURVEYS

There are five questions for evaluating CV instruments:

1. Do respondents understand the good being valued?
2. Do respondents have experience in valuation and choice procedures?
3. Is there clarity about the details of the project?
4. Does the survey ask for WTP rather than WTA?
5. Does the survey instrument avoid anchoring and starting point bias?

# Heuristics for Using Estimates from Previous CV Studies

- Specify which studies and specific estimates are used.
- Specify assumptions made in the extrapolations.
- Specify any quality changes involved.
- Specify distinctions between use and nonuse components.
- Perform sensitivity analysis.
- Specify any potential remaining biases