Communicating uncertainty in Cost-Benefit Analysis: a cognitive psychological perspective’

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Agenda

• First part: some results PhD-thesis
  1. Ranking the substantive problems in the Dutch CBA practice;
  2. **Attitudes towards the role of CBA in the decision-making process**;
  3. Perceptions of solutions for substantive CBA problems;
  4. Managing the ‘insolvable’ limitations of CBA: results of an interview based study;

  5. A Comparison of the Danish, Dutch, UK, Norwegian and Swedish CBA practice;
  6. **Communicating uncertainty in Cost-Benefit Analysis: a cognitive psychological perspective**
Attitudes towards the role of CBA

• **86 key actors in the appraisal process for spatial-infrastructure projects:**
  - Civil servants, politicians, academics, consultants, interest groups;
  - Both ‘known proponents’ and ‘known CBA antagonists’.

• **Investigated their perceptions of:**
  - CBA Advantages and Disadvantages;
  - Position CBA should have in the decision-making process.

• **74 filled out additional questionnaire**
Advantages CBA

• CBA provides *in order of magnitude* insight in welfare effects for the Netherlands

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Advantages CBA

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- Why would Truus from Appelscha pay 200 euros extra tax for this project in Amsterdam?
CBA advantages

- Forces to make lines of reasoning objective;

Everyone understands that we have to do this project.
CBA advantages

- **Systematic and compact**
CBA advantages

- **Optimization of the project;**
  - Optimizing 1: *after the CBA*; useless elements out of the project;
  - Optimizing 2: *in advance*; in the planning process more attention to costs and benefits of the project, see Eliasson and Lundberg (2012).

- Improved decision making: *bullshit detector.*
  - Hi-speed rail Albacete – Toledo
    - Opened in 2010;
    - 16 persons a day;
    - 1126 euro for every passenger;
    - Closed in 2012.
Disadvantages CBA when used in practice

CBA inherent limitations:
- Incomplete
- Effect estimations always uncertain
- Effects easy to estimate dominate

CBA users are insufficiently aware of limitations as a result of poor communication

Participants who are aware of limitations use them strategically

(Some) CBA users assign too much value to CBA in the decision-making process

(Some) CBA users assign too little value to CBA in the decision-making process
Position CBA
Position CBA

How do you perceive the **value** that is assigned to CBA in the **current** decision-making process?
Conclusions

- Consensus CBA must have a role;
- Controversy among economists and spatial planners
  - In regard to the value assigned to CBA
  - Assigning incorrect value perceived as important disadvantage
- Assigning an adequate value is desirable
  - *Virtuous* / *nuanced* use of the CBA
The role of Cost-Benefit Analysis in the Dutch planning process

CBA is worthless

Holy Grail
How to enhance virtuous use of the CBA?

**Solution most frequently mentioned:**

- CBA reports should be honest about uncertainties surrounding effect estimations and marked the advantages!
- Van de Riet (2003): in three case studies stakeholders are very unsatisfied with the way uncertainties are communicated.

**Some respondents:** this is ‘the salvation’ of the CBA in the Netherlands because:

- It will effectively reduce absolute use of the CBA outcome;
- It diminishes suspicion by skeptical actors.

**Other respondents:** this is ‘the collapse’ of the CBA in the Netherlands:

- Uncertain message causes delay. Politicians detest delay;
- Politicians will not consider a CBA report that communicates an uncertain message as useful information.

Social-psychological theory provides a way out of this dilemma?

• **Research aim:**
  • Enhance insight into the question of how uncertainty should be communicated in CBA reports so that users with different psychological characteristics:
    1. **Understand the uncertainty**;
    2. **Consider the information as useful input**.

• **Aim** of our study is to enhance our understanding of the dilemma and find a beginning of an answer not to provide a final answer.
Our approach

- **Step 1:** Scrutinize social-psychological literature that discusses individual differences regarding processing uncertain messages;
- **Our conclusion:** necessary to combine different theories.

- **First theory:** Dual-process theory of reasoning:
  - How do individuals process information in general?
- Individuals may employ two modes of thinking when processing information:

- **System 1:** process information heuristically; effortless, intuition, emotions and memories;
- **System 2:** process information systematically; effortful, neutral, facts, logic, evidence.

- Kahneman, 2011: System 1 is always active and System 2 is only active if an individual perceives that System 1 does not reach realistic conclusions.
Costs and benefits of using System 1

- **Benefit System 1:** it is highly economical. Usually an effective means of finding satisfactory solutions in familiar situations;

- **Costs of using System 1:** use of heuristic way of processing information can lead to bias and error.
  - Individuals that process information heuristically will not notice uncertainties when uncertainties are communicated after point estimates:

- **Anchoring heuristic:**
  - Individuals assume that the actual effect cannot differ that much from the point estimate.
Heuristic readers unaffected

- CBA users that process information in a heuristic way unaffected by ‘late’ presentation of uncertainties;
- Hence, ‘heuristic people’ only understand uncertainty when CBA reports first communicate uncertainty,
  - And only then carefully give some hints as to what could be plausible outcomes;
- Heuristic inquiries are used against itself: when confronted with uncertainty first, it becomes less likely for the individual that the outcome can be expressed in a single number;
- **Is a report that communicates an uncertain message still useful?**
  - A report that first communicates uncertainties, does not serve heuristic message processing. Actors are not enabled to reach conclusions immediately.
The flamboyant heuristic individual

- Heavily relies on his intuition;
- A priori sceptical towards the added value of research reports;
- Will almost exclusively use System 1 to process information;
- System 2 is necessary for processing the uncertain message;
- Probability is high that the individual will not decide to activate System 2 and will rely on his intuition;
- When uncertainties are presented first, this individual will not consider the information of the CBA report at all;
- Hence, prominent communication of uncertainties results in diminishing use of information.
Possible solution: enhance use of System 2

- Factors that determine whether individuals will employ System 1 or System 2 are Motivation, Ability and Opportunity.
  - **Motivation:** are individuals willing, interested to process a message;
  - **Ability:** competences to accurately interpret and understand a message;
  - **Opportunity:** exposure time, message length and the absence of distractions.
- Difficult to influence Ability and Opportunity of Flamboyant individual
- Three types of Motivations to use a CBA report:
  - **Challenge:** using information to challenge current opinion on the project for the sake of making better decisions;
  - **Strategic:** apply information according to their own liking, for the sake of serving their political or personal interests;
  - **Absolute:** fully base the decision on the outcome of the CBA report.
Hypothesis: individual differences influence *Motivations*

- Three types of individual differences (cognitive styles) that can be related to the processing of uncertain information influence *Motivations*.

**Need for Cognition:**
- “I would prefer complex to simple problems”;
- “I find satisfaction in deliberating hard and for long hours”;

**Personal Need for Structure:**
- “I hate to be with people who are unpredictable”;
- “I don’t like situations that are uncertain”;

**Personal Fear of Invalidity:**
- “I prefer situations where I don’t have to decide immediately;”
- Highly concerned about the possible consequences of a choice.
Hypothesized relationships between cognitive style and Motivations

- **Need for Cognition (NC):**
  - Positive with Challenge motivation:
  - Negative with Strategic motivation:
  - Negative with Absolute motivation:

- **Personal Need for Structure (PNS):**
  - Negative with Challenge motivation:
  - Positive with Strategic motivation:
  - Positive with Absolute motivation:

- **Personal Fear of Invalidity (PFI):**
  - Positive with Challenge motivation:
  - Unrelated with Strategic motivation;
  - Positive with Absolute motivation:
Conceptual framework

- Hypothesis: cognitive characteristics influence actors’ motivations in the processing and use of CBA reports in decision-making processes.

- Our aim was to enhance the motivation to process uncertain info and activate System 2.

- **Conclusion:** this is really difficult. We assume low NC and low PFI.

- The flamboyant individual will at best ‘Strategic’ and never ‘Challenge’;

- Solution: enhance Personal Fear of Invalidity.
Some remedies to attain our double objective

- **Double objective:**
  1. Users understand the uncertainty;
  2. Still consider the information as useful input in the decision-making process.
- **Increasing Motivation by enhancing Personal Fear of Invalidity:**
  - Bruzelius et al. (2002): decision makers are held personally accountable for their decisions.
- **Enhance Opportunity** of individuals increases the chance that individuals will make the cognitive effort (System 2) to understand the uncertainty.
- **Customize environmental characteristics of message:**
  - Lay-out;
  - Report presented by THE expert in the field;
  - Attractive individual presents information.
Conclusions

- Individuals that predominantly use System 1 to process information only understand uncertainty when CBA practitioners *first* communicate uncertainty in the CBA report;
- ‘Flamboyant heuristic individuals’ might completely ignore a CBA report that *first* communicates uncertainty;
- Some remedies;
- **Further research:**
  - Should we focus on individuals?
    - Decisions are made in groups
    - Should we influence politicians or senior civil servant?
  - The extent to which understanding of uncertainty enhances when communicated very prominently has not been tested;
  - Hypothesized relationships between ‘cognitive styles’ and ‘motivations to use CBA’ should be tested.
Any questions

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