Studying Decision-Making processes applied by participants in Participatory Value Evaluation surveys

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Abstract

The research discussed in this article considers decision-making of participants within the participatory public project appraisal methodology of Participatory Value Evaluation. In this relatively new method citizens are presented a survey with a portfolio-construction task for public projects that are defined by descriptions and attribute values. This research adopts a process approach by studying decision-making processes of survey participants. These are explained using decision-making constructs from literature. The research applied a process tracing study in which ten participants completed a realistic PVE survey of medium complexity while verbalising their thoughts. Analysis of the verbal protocol revealed the three strategies of additive, elimination-by-aspect, and weighted additive. Participants applied strategies multiple times or mixed them. Three effort-reducing methods were identified: examining fewer attributes, integrating less information, and examining fewer alternative. A method specific to the portfolio-construction task was identified: sequential evaluation, with which subsets of projects are evaluated separately. Not all participants were found to apply effort-reducing methods. Based on the outcomes it is recommended to allow participants to vote-down projects, incentivize comparison of all projects, and provide clear choice task instructions.

Keywords: Participatory Value Evaluation, Citizen participation, Decision-making, Behavioural economics, Process tracing

Nomenclature

CBA	Cost Benefit Analysis
PVE	Participatory Value Evaluation
USWM	Urban Storm Water Management
WTP	Willingness To Pay

1. Introduction

Public policy-making is supported by public project appraisals. Appraisal methods are used to value the expected impacts of public projects. This is done with the aim to identify the projects that result in the highest benefits for society. Such appraisals are generally executed using cost-benefit analysis (CBA), which is the standard in many western countries (Mackie et al., 2014). CBA is used to determine the societal desirability and economic efficiency of a proposed policy or project by expressing both costs and benefits in monetary terms (van Wee, 2012). If the benefits outweigh the costs the policy or project is considered beneficial to society. In the CBA appraisal process estimations of consumers private Willingness To Pay (WTP) are applied. This approach is criticised

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because people might make different decisions when allocating public budget versus spending their own money, as argued by Sunstein (2005) in the area of environmental policy. Also, CBA does not incorporate citizen participation and therefore there is a search for alternative or additional public project appraisal methods based on citizen participation.

PVE is a methodology that promises to combines aspects of CBA with public participation. Public consultation is done through an online PVE survey that is distributed to a large group of citizens that is reflective of the entire population. Within this survey the participants are asked to perform a portfolio-construction task by selecting a portfolio of projects from a range of project alternatives while adhering to a limited budget (Mouter et al., 2019a).

Outcomes of a PVE are quantitative and qualitative results, namely the selected projects per participant as well as motivations per selected project provided by participants. The quantitative results are analysed using choice models and the qualitative results are analysed through coding of statements (Mouter et al., 2019a). The outcome of a PVE are recommended portfolios of projects that fit within the budget, supplemented with an overview of the motivations provided by participants. These motivations can provide insights into the preferences and considerations of participants.

Since its conception PVE has been applied on various types of projects at different political levels (Dartée, 2018; Mouter et al., 2019a,b; Pak, 2018):

- Flood protection scheme on the Dutch national level.
- Transport investment scheme in the municipal region of Amsterdam.
- Urban storm water management (USWM) programme in the municipality of The Hague.
- Transition to zero natural gas in the neighbourhood of Hengstdal in the city of Nijmegen.
- Bicycle projects in a generic context to investigate the effect of framing of the information provided to survey participants on the results of a PVE.

Mouter et al. (2019b) propose, among others, further research on PVE specifically within the field of information provision to the respondents. Analysis of the qualitative results of their research, in the form of statements provided by respondents, indicated that respondents tend to take impacts and considerations into account that are not included in the survey information. Inclusion of such considerations might result in reduced validity of the survey outcome, partly because respondents tend to over- or underestimate the related impacts when they are not provided the appropriate information. The research that the authors propose intends to develop the PVE further into, for example, an iterative method where outcomes of PVEs of a smaller size are used to design subsequent larger scale PVEs. Also, research into the application of novel methods of information provision is proposed, such as immersive and visual information.

2. Research objective

As shown in the previous chapter, the field of research on PVE is still very small and fully in development. All PVE surveys to date have applied the same online tool with the same setup consisting of a main screen with the project titles, specific project pages with description, location, and attribute information, and a comparison page where participants can make a comparison of the attributes of selected projects. The PVEs listed above contained up to 16 projects, each associated with a cost, description, location, and scores on 6 attributes. Therefore, the choice task that participants face within a PVE survey can be considered highly complex. Currently, it is not known how participants approach the choice task of a PVE and how they interact with its interface.

Also, the developers of the PVE methodology have stated a desire to develop innovative ways of information provision, such as immersive and visual information (Mouter et al., 2019b). To facilitate this development it is necessary to understand how participants approach PVE in its current form. If it is not known how participants make their decision in a PVE survey this can lead to results that cannot be explained or invalid conclusions. Knowing how participants approach the portfolio-construction task can aid the design of PVE surveys and the online tool to better suit the decision-making processes applied by participants and to elicit the preferences that policy-makers intend to capture.

Therefore, the research question addressed in this article is: **What decision-making processes are applied by participants while completing a portfolio-construction task in a Participatory Value Evaluation survey?**

3. Methodology

3.1. Approach

For studying decision-making two distinct approaches are identified: a structural analysis of the resulting choices and process tracing techniques (Svenson, 1979). The former approach includes the use of choice modelling to examine the effects of the input on the output of a choice situation. The choice modelling applied in PVE is such a structural approach. With a process approach the focus is on collecting data while the decision-maker is in the process of making his decision. This fits within the model of behavioural economics, which posits people possess or are only willing to apply limited cognitive abilities (Gsottbauer & van den Bergh, 2011). It is theorised that to deal with a choice task people tend to make use of rules-of-thumb or decision shortcuts when making a decision, which are commonly referred to as heuristics (Gsottbauer & van den Bergh, 2011; Kahneman, 2003). These are closely associated with the idea of cognitive misers (Petty et al., 2005).

Studying how participants deal with the portfolio-construction task calls for adoption such a process approach. Therefore a process tracing study is performed to answer the research question. Process tracing is defined by Shah & Oppenheimer (2008) as: *"Process tracing refers to observing how people search for information before making a judgment or decision."* By using process tracing researchers can determine the types of decision-making processes that are applied by participants. Therefore, this approach is suited to answer the research question. Process tracing studies result in large amounts of data (Schulte-Mecklenbeck et al., 2011). Therefore the study is limited to a group of ten respondents.
In this research two forms of process tracing are applied: subject reports consisting of verbal reports by decision-makers, and movement based techniques in which an action log is composed of the actions of decision-makers (Schulte-Mecklenbeck et al., 2017). The verbal reports are generated by the respondents concurrently with the execution of the choice task and in an unstructured manner by asking the respondents to think aloud (Walsh & Gluck, 2016). The verbal reports are captured using an audio recording. The actions of respondents are logged by making a screen recording of the online tool. Because the online tool consists of different pages with information this is comparable to the information boards technique in which information is hidden until the decision-maker chooses to consult it (Schulte-Mecklenbeck et al., 2017).

3.2. Process tracing techniques

The outcomes of the process tracing study are screen and audio recordings. The former is used to compose the action log. The latter is transcribed and divided into statements that represent a

complete thought, following the methodology of Walsh & Gluck (2016). These statements are then coded in two rounds, first categories are established and secondly the statements are assigned to these categories. In addition, to facilitate analysis the verbal protocols were shortened by only including the most relevant statements and short reports were made describing the expressed thoughts and performed actions for each participant.

3.3. Decision-making constructs

Interpretation of the verbal protocols and action logs is done by identifying decision-making strategies and effort-reducing methods that are based on literature. Effort-reducing methods form the basis of heuristics (Shah & Oppenheimer, 2008).

Decision-making strategies: five strategies were identified from literature (Payne, 1976), (Payne et al., 1993, as cited in Shah & Oppenheimer, 2008): 1) Additive/linear, in which the decision-maker assigns scores for each attribute of each alternative to arrive at composite scores using which the best alternative is chosen. 2) Conjunctive/satisficing, in which each attribute is checked against a minimum level and if the alternative does not pass it is discarded. After which it is hypothesised that the minimum level is altered, using which the alternatives are re-evaluated. 3) Additive difference, in which the difference between the levels of a certain attribute of two alternatives are evaluated. It is hypothesised that the best alternative is used as a benchmark until a better one is found. 4) Elimination-by-aspect, in which the attribute that the decision-maker considers most important is chosen and with which the alternatives are evaluated. 5) Weighted additive, which is a more complex version of the additive/linear strategy in which weights are assigned to the different attributes.

Effort-reducing methods: five effort-reducing methods were identified (Shah & Oppenheimer, 2008): 1) examining fewer attribute levels, 2) reducing the difficulty associated with retrieving and storing attribute levels, 3) simplifying the weighting principle for attribute levels, 4) integrating less information, and 5) examining fewer alternatives. These five methods are related to the weighted additive strategy described above. It is expected that effort-reducing methods 1, 4, and 5 are encountered. In case participants focus on specific attributes and disregard the other attributes they employ method 1. When participants evaluate an alternative on its own without making a comparison to the other alternative they are using method 4. And, when participants disregard alternatives altogether they employ method 5.

3.4. PVE survey

To conduct the process tracing a realistic PVE survey was designed. Therefore, a PVE survey[2] was composed containing six infrastructural projects at or near the Delft University of Technology campus which were actual plans being considered by the municipality of Delft, the province of South-Holland, or local political parties. The projects were associated with project cost and five other attributes related to change in travel time and number of direct car users and cyclists. They were further defined using a title, short description, and a location. With the content established the PVE survey was composed in the same online tool that was used for the earlier PVE applications.

In line with previous PVE applications, the choice task instruction was as follows: *"..there are plans to improve accessibility. However, there are not sufficient funds to execute all these project plans.*

[2]The applied survey is accessible through: `http://pve.splicedgene.com/process-tracing-experiment`

Therefore, choices will have to be made. We ask you in this research to make that choice and to spend the available funds on the projects that you find most important."

After having composed their desired portfolio of projects, the participants of the study are asked to complete a questionnaire in which they are asked to provide socio-demographic characteristics. These serve to understand to what extent the results of the study can be generalised.

4. Results

The 10 participants, identified using letters ranging from A to J, were recruited from the personal network of the researcher, namely friends and neighbours. The ten sessions resulted in a total of 906 statements and 351 actions.

4.1. Sample characteristics

The sample captured in the process tracing study is composed mainly of young people in the age groups of 18-25 and 26-35, either studying or working, and two people within the 65+ age group, working. All participants were higher educated and almost all participants lived in the inner city of Delft, with two others living in the same neighbourhood which contains the campus. Regarding the votes the green party of GL dominates. Most participants use the bicycle as the main mode of daily transport and none of the participants use a car.

4.2. Analysis of verbal protocol and action log

Table 1 shows the recorded counts of statements and actions as well as the time spent on the selection per participant.

Table 1: Counts of statements and actions and time spent on selection per participant

Participant ID / Variable	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
Statements [count]	45	112	90	61	77	89	62	94	146	130
Actions [count]	33	19	44	23	34	29	26	40	67	36
Time [minutes]	6:14	11:58	13:15	6:23	8:55	12:31	6:01	7:11	12:14	21:05

The counts of statements and actions as well as the shortened verbal protocols and thought and action reports were analysed with the objective of explaining decision-making behaviour using the strategies and effort-reducing methods as described earlier. The identified processes are discussed below.

For the effort-reducing methods, an additional method was identified that relates directly to the portfolio-construction task that is considered in a PVE survey. This method is termed: sequential evaluation. When applied, instead of one simultaneous evaluation in which the full selection is made participants make sequential evaluations. For instance, instead of simultaneously considering the selection of three projects out of the total of two projects, participants first select the two best projects and then make another evaluation out of the reduced choice set. By not constructing the entire portfolio in one go the required effort is reduced.

Decision-making strategies: the additive/linear strategy was applied seven times by five participants (A, B, C, F, and H). Of these, five applications were purely attribute focused and two

applications focused on cost-benefit ratios. The elimination-by-aspect strategy was applied six times by five participants (D, E, F, G, and H), all based on a variety of non-attribute aspects. These aspects were: personal benefits, reduction of traffic related burdens, equity considerations, substitution of car traffic, equity considerations, perceived project feasibility, and whether projects were car or bicycle focused. The weighted additive/linear strategy was applied once using attribute levels by one participant (J). For one participants the applied strategy could not be determined (I). The strategies could be directly linked to whether participants took the attribute values into account or whether they considered other aspects. The (weighted) additive/linear strategies all made use of the attribute values, while those applying an elimination-by-aspect strategy made use of non-attribute aspects.
Not all participants applied only one strategy once. Instead, five participants were observed applying a strategy twice. When they did this they first made a choice and subsequently made a new choice out of the remaining projects. This is related to the identified effort-reducing method of sequential evaluation, as described below. Out of these five participants two applied an additive/linear strategy twice (A & B), one applied the elimination-by-aspect strategy twice (G), one applied first an elimination-by-aspect strategy to reduce the choice set and subsequently applied an additive/linear strategy (H), and one applied first an additive/linear strategy to select two projects with the best cost-benefit ratio and subsequently used an elimination-by-aspect strategy for the remaining projects (F).

Effort-reducing methods: two participants (B and H) reduced the effort by examining fewer attributes, while three participants integrated less information (D, E, and G) and four participants (A, B, E, and G) reduced the choice set by examining fewer project alternatives. The sequential evaluation method was applied by three participants (A, B, and C). As with the strategies, several participants applied multiple methods. Not all participants applied an effort-reducing method as for three participants (F, I, and J) none could be identified.

5. Conclusions

The research served to answer the research question: *What decision-making processes are applied by participants while completing a portfolio-construction task in a Participatory Value Evaluation survey?*
The results showed that participants applied three decision-making strategies: additive/linear, elimination-by-aspect, and weighted additive. Four effort-reducing methods were identified: examining fewer attributes, integrating less information, examining fewer alternatives, and sequential choices. This last method was identified in this research and applies to the portfolio-construction task of PVE surveys specifically.
It is concluded that participants who complete a PVE survey tend to either focus on the attribute levels or on other aspects of project alternatives. The former is associated with (weighted) additive/linear strategies, while the latter is associated with elimination-by-aspect strategies. However, participants might adopt both strategies by using one strategy to reduce the choice set and using another to evaluate the remaining projects, or applying the same strategy twice. This is one of the effort-reducing methods that were identified as participant were observed to not take into account specific attributes, ignoring part of the provided information, or swiftly reducing the choice set by discarding projects. Additionally, another effort-reducing method was identified that was specific to the portfolio-construction task presented in PVE surveys in which participants chose to make a sequential choice instead of a simultaneous choice for the full portfolio. Not all participants were

observed to apply effort-reducing methods as three out of ten participants based, or tried to base, their selection on all available information, which was still possible with the relatively low level of complexity of the applied PVE survey.

6. Discussion

6.1. Participatory Value Evaluation

This research showed that not all preferences of participants are captured in a PVE survey because part of the participants reduce the choice set quickly. Such a specific dislike for a project that is not based on attribute levels or a full consideration of the project is not captured in the current PVE methodology. It is recommended to include the option for participants to vote-down projects.
Also, some participants were found to ignore specific attribute levels, attributes in general, or other parts of the provided information. Currently, there is an incentive to disregard projects because participants have to actively include projects in a comparison. Therefore, it is recommended to include all projects in the comparison by default instead of none of the projects as is the current standard.
Knowing what the policy-maker applying PVE methodology intends to measure and presenting the PVE survey accordingly is deemed to be important. The choice task instruction was found to be a cause for confusion because participants mused about basing their decision on the provided attribute levels, their own interpretation of projects and their impacts, personal benefits, or other aspects. It is recommended to provide a clear choice instruction to participants, instead of the current ambiguous instruction.

6.2. Behavioural economics

This research provides an empirical example of the strategies and effort-reducing methods that were identified. Within the category of effort-reducing methods an additional method was identified which is applicable specifically to portfolio-construction tasks as presented in PVE surveys. Also, this research shows that within complex choice tasks such as a PVE survey participants might adopt strategies multiple times or even mix strategies while completing the same choice task.
Also, this research provides empirical evidence for the theory of cognitive misers, part of the behavioural economics paradigm, which says that people are not able to, or not willing, to process all available information. This was clearly demonstrated in the process tracing study, together with the heuristics and their underlying effort-reducing methods that participants applied.

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