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EPARTICIPATION GALORE?

- EXTENDING MULTI-CRITERIA DECISION ANALYSIS TO THE PUBLIC

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Abstract

New approaches and tools are required because of the increasing request for public participation and democratic decision making. There are two particular major challenges associated with this namely, applications allowing for large numbers of users and the balancing of participation and expertise. This article tests a method attempting to achieve this by combining a multi-criteria decision approach with different forms of discussion and deliberation. The method involves relaxed requirements for user exactness in statements of opinion and was tested on 90 students aged 17-19. Is it possible to extend multi-criteria decision analysis to the public? In order to answer this question, our research focuses on (1) scalability, or the potential for increased participation, as well as (2) decision quality, i.e. whether the alternatives are reflected upon and if there have been reasoned judgments. The test and survey found both these criteria met. The findings suggest that the method can be used for large scale participation during a decision making process, but also that a participatory process is improved by lengthier deliberation and more than one point of measurement so that opinions can stabilize.

Keywords: democracy**,** elicitation, participation, e-participation, multi criteria decision analysis

1. Introduction

Participation is flourishing on the Internet. Web 2.0 technologies have led to a surge in social activity on the web, and many technologies are used for various kinds of human interaction and cooperation. Participation under the specific label of eParticipation is also an emerging research field [Sanford and Rose 2007], and it is high on the agenda in the EU as well as in many countries [EU 2009; CitizenScape 2009]. The observation of a "democratic deficit" [Dalakiouridou et al. 2008; Steffek and Kissling 2007] has led to a call to involve the public more in policy making, but both the methods to do this and the theoretical foundations of those methods remain unclear. What is meant by participation? Who should participate, how, and when in the policy-making cycle? Neither of these questions is unambiguously answered, either by practitioners or researchers. Yet there are, and have been for at least a decade, numerous projects and tools developed to increase and support "participation".

The European eParticipation study [Panopoulou et al. 2009; Smith and Dalakiouridou 2009; Dalakiouridou et al. 2009] reviewed eParticipation projects in Europe and found that, although there are numerous projects and often good intentions, the level of participation is not very impressive. Most projects concern information to the public and the opportunity to provide comments on various policy initiatives, e.g. as in EU green papers. From a participatory point of view a common criticism is that there should be more of discussion and deliberation, not just comments [Grönlund 2009; Barber 1984; Lukensmeyer and Tores 2006; OECD 2001]. For this purpose, a great number of eParticipation tools have been developed over the past 20-some years [DEMOnet 2009a; infoDev 2009]. The majority have been designed for social contexts and involve social interaction and discussion, including among other things blogs, e-petitioning and chat rooms [DEMOnet 2009b]. Some are designed to support decision making, e.g., tools for polling and voting. Moreover, there are tools for structuring and visualizing discussions [Wave 2009]. However, virtually no systems in the eParticipation field involve formal problem modelling and simulation or a prognosis of the outcomes of decisions [Medaglia 2007]. Tools of the latter kind have been developed within the field of Decision Support and Analysis (DSA), but these have, so far, mainly been used by small expert groups and do not, e.g., include tools for deliberation. In terms of research, the DSA and the eParticipation communities have largely been separate, focusing on different aspects of participation, as well as, different social contexts [Grönlund 2003]. Thus, although decision analytic methodologies offer an effective and valuable means of communicating and structuring participatory processes [Gregory et al. 2005; Rios Insua and French 2010], there is a need to adapt them to participatory processes and to facilitate their usage by decision analytic novices.

Against this backdrop, this article reports a project in which a tool for problem modelling and decision analysis has been used for the purpose of developing participation, both in terms of the number of participants and the quality of decision. The web based method introduces novel ways of eliciting individuals' views on criteria importance using the CROC weight elicitation method (see more in [Riabacke et al. 2011]). The motivation behind the choice of the CROC method to elicit criteria weights was based on its imprecise extraction procedure, as it does not force decision-makers to express unrealistic precision, yet does not ignore weaker forms of cardinality, which often exist. The CROC extraction part was also perceived as being practicable in relation to the web based method, which also includes the registration

of views, deliberation and expert based evaluations of alternatives. Thus an attempt was being made to integrate the knowledge achieved so far within the two hitherto largely separate research fields.

The context for the testing of our tool will be within the field of urban planning, and there are at least two good reasons as to why this is a suitable policy area for research and development. Firstly, urban planning affects the living conditions of all of its inhabitants, and therefore western democracies and indeed the majority of countries require some kind of citizen participation by law. Furthermore, the development of the Internet has led to recommendations to offer on-line opportunities for participation in Sweden as well as in other countries [SOU 2001:48]. Secondly, there is a strong demand for expertise, as well as citizen participation, in most planning issues. However, it is not possible to maximize both of these aspects. Accommodations have to be made, and it is into this balancing act that we are making an entry. The specific planning issue in relation to which the tool was tested concern a long-debated problem regarding the different ways of improving the water quality of Svartån (Black River), a river running through the city of Örebro, Sweden. The tool was used both by politicians and a sample of the public, namely students at upper secondary level, i.e. ages 17-19, who are about to enter into political life (voting age in Sweden is 18). The article primarily reports on the trial associated with the students, but also includes some data from the trial with politicians for the purpose of comparison and analysis.

Is it possible to extend multi-criteria decision analysis to the public? In order to answer this question, our research focuses (1) scalability, or potential for increased participation, as well as (2) decision quality, in terms of technical aspects and individual preferences. We thus intend to analyse whether the tool is sufficiently easy to use, individually and remotely, as well as whether it is sufficiently understandable for the students within a reasonable amount of time (requirements for scalability). We also intend to study whether the opinions expressed are reasoned, i.e. whether the students understood the problem at hand, and the proposed alternative solutions, so that they could take part in well-informed discussions (requirements for decision quality).

These practical research questions are theoretically motivated and relate to a striking decision making dilemma in modern democracies. We appear to face, as the American political scientist James Fishkin has stated (1991:1), “a forced choice between politically equal but relatively incompetent masses and politically unequal but relatively more competent elites”. On the one hand, large scale participation often takes the form of partisan lobbying or even spamming [Schlosberg et al. 2007], i.e. ideologically or interest-based argumentation promoting only one particular view in relation to a problem and ignoring the others. On the other hand, many decisions are still taken in smoke-filled rooms where political equality is sacrificed. By contrast, the tool introduced in this case offers a kind of large scale participation for which the problem is systematically structured in a formal model and the different alternatives compared and analysed using decision analysis methods.

The paper is designed as follows. Section 2 discusses the theory involved in two stages. Section 2.1 concerns the political reason and the problem of balancing participation and expertise. Section 2.2 concerns decision support and analysis and the problems of eliciting user preferences, and section 2.3 describes our approach to this problem. Section 3 briefly describes the case and our method for the study. Finally, Section 4 presents the results and Section 5 discusses the findings and future research requirements.

2. Balancing participation and expertise

The specific problem addressed in this article is thus that much of the practical development of online policy making has been developed in two different and separate camps, decision analysis on the one hand and eParticipation on the other. These areas of research and development are often poles apart, conducted by scholars from different disciplines and discussed in different literature, conferences and so forth (an exception can be found in the compilation by Rios Insua and French, 2010). At the same time, issues and problems cut across each other. Thus, if viewing on-line planning from one isolated perspective is not leading to comprehensive solutions, we believe that a combination and integration of perspectives might provide better prospects. The following sections provide a background to some of the ideas concerning participation and expertise in the field of planning and also a description of decision support and analysis, including multi-criteria decision analysis.

2.1. Rationalist and communicative planning

The roots of modern planning can be traced back to the late 18th century and the enlightenment. This is important because the enlightenment tradition and its perception of knowledge and rationality added an exceptional vigour in planning theory right up to the present day [Allmendinger 2001]. The focus has been on instrumental rationality and on systematic, scientific, knowledge and a focus on planners as experts.

This view has been subject to an increasing critique. One aspect of the critique focuses on the perceived lack of awareness concerning the meaning and impact of politics [Wildavsky 1987]. Another aspect of the critique concerns the perception of relevant knowledge in the planning process, which focuses on expert-knowledge [Fischer 1990]. It has been stated that citizens' experienced-based knowledge is important for planning and that it ought to be included in the planning process through an extensive interaction between the planners and the citizens. This is, of course, paired with a critique of the role for citizen participation in traditional planning which has been very limited and has been framed by the ideal of representative democracy.

During the eighties and nineties, this critique developed into a planning paradigm of its own, the communicative paradigm [Fischer and Forester 1993; Healey 1997; Sandercock 1998]. Much of the inspiration came from the theory of communicative rationality as formulated by Jürgen Habermas, from American pragmatism, but also from Foucault. Communication is the central focus of attention but, in addition, there is the perception of knowledge, which has been inspired, to a significant extent, by the social constructivists. The communicative paradigm entails a direct challenge to the supreme position of expert knowledge in traditional planning. Instead the tendency is to perceive planning as a political and democratic activity. Advocates of communicative planning argue that public interest can be understood only through consultation with the public.

The theoretical debate between the rationalist and communicative planning ideas is at the core of many studies involving technology, planning and politics. As Åström and Granberg (2007) argue, the opportunities for information and communication via digital technologies may affect the practice of planning by reinforcing the traditional values of instrumental rationality and expertise or by contributing to institutional

change in line with the ideal of communicative planning. The reinforcement model states that the emergence of new technologies primarily provides opportunities for handling large amounts of information and data, which paves the way for comprehensive planning and a possible strengthening of the professional/expert planner in line with a neo-rational planning model. In the model for change, the opportunities for e-participation are changing the direction of these planning practices towards participatory democracy and communicative planning.

However, this does not have to be an either/or relationship. Different hybrid models of participation and expertise are possible, in which appropriate roles are given to experts as well as to members of the public. The challenge has been to put such a goal into practice. One possible solution is suggested by Fishkin´s (1991) "Deliberative Poll". In this innovative method, a random, representative sample is first polled on the targeted issues. After this baseline poll, members of the sample are invited to gather at a single place for a weekend in order to discuss the issues. Carefully balanced briefing materials are sent to the participants and are also made publicly available. The participants engage in dialogues with competing experts and political leaders based on the questions they have developed in small group discussions with trained moderators. Parts of the weekend events are broadcast on television, either live or in taped and edited form. After the deliberations, the sample is again asked the original questions.

Deliberative polling is an interesting method that has been successfully implemented in several countries, for a range of issues, but it has some important disadvantages, i.e. the high costs involved and the work load on the participants. More recently it has been argued that the Internet offers a potential solution to the geographic inefficiencies and high costs of a conventional deliberative process that brings people to one site. However, the field of eParticipation still lacks the tools in relation to the understanding of a problem. Modelling discussions retrospectively by means of charting a discussion is insufficient and there is also a requirement to introduce some *formal problem modelling* so that the available technical knowledge is properly taken into account. Political discussion must be able to cater for both facts and opinions. Additionally, it is necessary to combine discussion with prediction or simulation, in order to clarify to the participants the direction to which the different alternatives will lead.

2.2. Decision support and analysis

Decision support and analysis proposes a candidate answer to the necessity for formal problem modelling as discussed above [Rios Insua et al. 2007]. In particular, prescriptive decision analysis (formal decision analysis informed by behavioural decision research) offers responsible support for deliberative processes, since such processes have both an analytical and a behavioural part [Gregory et al. 2005]. An important aspect, which must be accounted for in prescriptive decision processes, involves how to formalize the opinions of citizens and, since they include their judgements, there is a requirement for a "behaviourally realistic approach to applying decision analytical tools" [Gregory et al. 2005, p. 6]. Some initiatives, which involve supplying web based tools for individual and group decision analysis support during decision making processes do exist, e.g., the Decisionarium site [Hämäläinen et al. 2003]. Another initiative in this direction is the Älgö project [Danielson et al. 2005; Danielson et al. 2008], where a structured decision process was supported by a decision support tool for individual decision making (DecideIT), and input from different stakeholders was incorporated into the analysis [Danielson et al. 2007].

However, it is still necessary to adapt these decision analysis methods in order to provide for the possibility of the inclusion of a larger number of citizens within the decision process.

French (2003) accounts for some issues that must be handled when integrating decision analytic methods into web software so as to provide the technological means for eParticipation, such as, e.g., the too high a cognitive burden that may be placed upon people (to explore decision models, express preferences etc.), and time requirements (do citizens have sufficient time in order to interact substantively?). The DSSs that are used in eParticipation initiatives are often based on tools that have traditionally been used by experts, and require extensive method knowledge and more time than the majority of citizens would be willing to spend. An important factor, which must be catered for in participatory democracy, is the distribution of support to an extensive number of users who may vary in cognitive and decision-making skills and styles [Rios Insua et al. 2007]. Capability, availability of time and scalability are thus issues of significant concern when employing decision analytic methods in participatory processes.

2.2.1. Multi-Criteria Decision Analysis

Multi-Criteria Decision Analysis (MCDA) provides a means to systematically structure and analyse complex decision problems. It has been argued that schools of decision analysis belonging to this category offer the most coherent forms of decision analysis with which to aid participatory processes [Gregory et al. 2005; Rios Insua and French 2010]. MCDA can provide decision-makers with a better understanding of the trade-offs involved in a decision, e.g., between economic, social and environmental objectives (criteria). MCDA is kin to social choice theory, but differs in relation to some important aspects. Instead of having decision-makers express themselves directly with regards to the alternatives, they express preferences (weights, or relative importance) for different criteria (perspectives) that are to be included in the evaluation of the available alternatives [Bollinger and Pictet, 2003]. Moreover, the decision-makers do not solely rely on their own judgements, but, additionally on the performance assessments of the alternatives on the criteria, which are often performed by domain experts. This adds a cognitive dimension, but also relaxes the alternative-focused approach, where great prestige can be attributed to the success of a particular alternative in the decision outcome. Separating the issues of values and facts, rather than focusing on alternatives, can also broaden the view of participants and open up their minds to more flexible thinking [Gregory et al. 2005]. Traditional MCDA software has typically been used by analysts, but extensions to traditional MCDA could provide the means to support democratic decision making by adding interactive parts for citizens to include them in the MCDA process.

The number of MCDA applications has increased during the last decade, but behavioural issues have not received a significant amount of attention, although the identification of such problems and the call for research within this realm has been long recognized [Wallenius et al. 2008]. A widely discussed practical difficulty in the use of MCDA models for decision making is in relation to the elicitation of decision data.

Multi-Attribute Value Theory, MAVT, and Multi-Attribute Utility Theory, MAUT [Keeney and Raiffa 1976; von Winterfeldt and Edwards 1986], are the oldest and most widely used MCDA methods in practical applications. The relative importance of each criterion is assessed, as well as, value functions, characterizing the

satisfaction of the alternatives (according to the decision-maker) under each criterion, and thereafter the overall score of each alternative is calculated. The most common form of value function used is the additive model: $V(a) = \sum_{i=1}^{m} w_i\, v_i(a)$, where $V(a)$ is the overall value of alternative a, $v_i(a)$ is the value score reflecting the alternative's performance in relation to criterion i, and w_i is the weight assigned to criterion i. The weights, i.e. the relative importance of the evaluation criteria, are a central concept in MAVT/MAUT methods and describe each criterion's significance in the specific decision context. This significance information refers to the decision-maker's opinions and represents his/her individual preferences regarding the decision problem at hand. The elicitation of weights is a cognitively demanding task [cf., e.g., Belton and Stewart 2002], and while the elicitation steps of the decision making process have been acknowledged as being problematic for quite some time [cf., e.g., Keeney and Raiffa 1976; Shapira 1995; Kirkwood 1997], the process of eliciting adequate quantitative information from people remains a challenge. When including citizens in an MCDA process, additional demands are placed on the elicitation methods to adapt to the users and context. Different situations call for different levels of exactness depending on the decision-makers' abilities to provide exact judgements. The conventional demand for numeric precision within elicitation is unrealistic for several reasons, e.g., due to people's problems of judging and expressing exact values [cf, e.g., Shapira 1995; Tversky and Kahneman 1986; von Winterfeldt and Edwards 1986; Lichtenstein and Slovic 2006]. The elicitation of exact weights demands an exactness, which may not even exist in the mind of the decision-maker [Barron and Barrett 1996]. Consequently, the use of more imprecise weight elicitation methods within participatory settings is a reasonable objective.

2.3. A Novel Approach to Participation using Preferences

As already mentioned, extensions of traditional MCDA could provide a means to support democratic decision making by the inclusion of interactive parts for citizens. When involving large groups of people, such interactive components are required to be scalable and it is necessary to provide simpler and less error prone methods and means of interaction, which do not add significantly to the cognitive burden or involve a great deal of time.

In this study, a web based method of eliciting importance judgements from a group of individuals using the CROC method [Riabacke et al. 2011] has been tested. This method could be used as part of a decision making process supported by an MCDA tool in order to collect public opinion regarding choice criteria. Thus, instead of allowing the citizens to only have an opinion on already created alternatives (voting), they can be involved at an early stage of the decision process by using the method to elicit their preferences regarding the identified criteria. The proposed method allows participants to express not only their preference rankings, but also their strength of preference regarding the criteria, without demanding numeric exactness. Moreover, when using the proposed elicitation procedure, value conflicts cannot arise, as in methods with a sequential approach, where each criterion is handled separately[1]. In addition, the interpretation of the user input can be handled imprecisely in the analysis, which is a more realistic representation with regards to preferences.

The idea of the used elicitation method is to provide users with a method that reduces the cognitive demands made on them by allowing for less precise statements of their

[1] Consistency requirements, such as that of transitivity, i.e. if A is preferred to B, and B is preferred to C, then A should be preferred to C, are maintained by the method.

views. Ranking methods using surrogate weights, such as e.g., centroid (ROC) weights [Barron 1992], reduce user demands since they are simply required to supply their rankings and are claimed to be less cognitively demanding on decision-makers [Barron and Barrett 1996]. There are several proposals regarding how the conversion of ordinal weight information (retrieved by ranking) to cardinal weights should be performed, e.g., rank sum (RS) weights and rank reciprocal (RR) weights [Stillwell et al. 1981], and centroid (ROC) weights [Barron 1992; Barron and Barrett 1996], but even though some weak form of cardinality may exist, cardinal importance information is not taken into account in the transformation of rank-order into weights. Consequently, the conversion may produce weight differences that do not closely reflect the meaning originally made in relation to the ranking by the decision-maker.

The CROC method, used in this case study [Riabacke et al. 2011], takes both ordinal information and also imprecise cardinal relation information regarding the importance of the attribute ranges into account, and interprets the criteria significance input as regions of significance. An elicitation procedure consists of three parts: i) extraction (extracting information through user input); 2) representation (capturing the information in a formal structure); and 3) interpretation (assigning meaning to the captured information). In its representational and interpretational aspects, CROC extends the ROC weight method [Barron 1992; Barron and Barrett 1996] into the handling of imprecise and cardinal information. If the cardinal information is omitted and only a ranking of criteria is provided, the results coincide with ROC weights. The user interaction stage of the procedure consists of three steps that can be iterated until convergence is achieved. In the first step, the user states the priority order by ranking them from most to least important (if two or more criteria are considered equally important, they will be ranked at the same level). In the second step, the user is asked to express his or her perceived difference in importance between the most and least important criteria (assess extremal criteria). Thereafter, the user is able to express his or her strength of preference in the third step by adjusting the initial (default) distances between the ranked criteria in order to express his or her views on the cardinal importance differences between them (state magnitude of differences between criteria).

The method was applied in a web application with a graphical user interface, where the user was guided through each step and could interactively iterate the steps until he/she was satisfied, i.e. until he or she felt that the criteria order, the scale and the distances between criteria gave an adequate representation of his or her preferences regarding the criteria.

3. Method

3.1. Case Background

During the winter of 2008/2009, the members of the urban planning board in Örebro, a medium sized municipality in Sweden with some 130 000 inhabitants, agreed to use a decision support method, including an MCDA tool, DecideIT [Danielson et al. 2003], for problem modelling and analysis, to support their decision making process regarding a long-debated problem regarding how to improve the water quality of Svartån (Black River), a river running through the city. The actual decision-makers were the governing politicians, but all political parties had been invited to participate in the work process since the problems associated with the river had existed during several election periods. For a number of years, there had been unacceptably high

amounts of intestinal bacteria in the water, and there was a need for action in order to meet EU regulations concerning sources for drinking water. The fact that even public baths along the river were deemed to be unsuitable according to EU regulations was an aspect often highlighted in the media. The problem was complex and included several stakeholders and points of view. Moreover, the source of the pollution in the river was mainly from the surrounding farmland and from other upstream municipalities, thus causing difficulties in relation to decision making as decisions were required from multiple locations. Remedies in relation to solving the pollution problem are also expensive as it was possible that this would involve changes with regards to farming operations. As a complication, during the election campaign 2006, a leading politician publicly promised to clean up the river by declaring "I will swim in the river by 2010". This added complexity as there are different requirements for bathing water (more relaxed) than for drinking water (stricter) and the political promise was made quite clearly, while the EU regulation problem was kept more in the background.

In public discussions, the primary goal of the decision-makers hence became to make it possible to swim in the Svartå river by the year 2010, but for the politicians there was, simultaneously, the necessity to reach a more sustainable (long-term) solution with a generally improved water quality. During the problem structuring activities at the beginning of the MCDA process, where the decision-makers discussed their objectives regarding the problem, it became apparent that the swimming objective was merely a symbolic proxy objective and that the larger and more complex issue was that of providing a long-term fresh water supply in the region. Consequently, the extended (main) objective of the decision-makers was to obtain a more sustainable solution. During the criteria workshop, the politicians jointly discussed and identified the political (main) perspectives they determined to be relevant for inclusion in the evaluation of the possible alternatives and this resulted in the following distinct criteria:

1. Practicability; (how easily measures could be realized). Some alternative actions would also require decisions from neighbouring cities which would make them more difficult.
2. Water quality
3. Nature/Wildlife
4. Economy/Costs
5. Impact on existing businesses
6. Ecological sustainability (of the constructed solution)
7. Bathability; the water meeting EU regulations for bathing

From a research point of view, this real-life decision making process included testing both how the political assembly involved could improve their decision quality and how increased participation could be achieved by eliciting preferences from a sample of the public (in addition to the politicians' preferences) regarding the main criteria. This paper addresses only the latter part, public participation.

3.2. Test Set-up

The study was conducted using 90 students at upper secondary school (ages 17-19) in Örebro. This group was chosen for a combination of strategic and practical reasons. The practical reason involved the favourable conditions for controlled experimentation in the school setting, and, simply, that this group was easily

available. More strategically, it was felt that the politically inexperienced group of students would make a good point of comparison with the group of politicians who also participated in the test. It might thus be stated that internal validity, in this case, was given a higher priority than external validity.

During a prescriptive analysis, perceptions change and evolve, and beliefs and preferences are not static. The decision-maker's view regarding what is important (and the relations) in relation to the decision often changes during the progress of the decision process as the understanding of the problem increases [French & Rios Insua, 2000]. Therefore, the elicitation method was applied on two occasions, with one week in between. For each participant a log file for his/her preferences from both elicitation occasions was saved in order to compare possible changes in views. The one week intermission was provided in order to make room for discussions and for each individual to contemplate their rating. We wanted to include both rating and deliberation, and were interested to determine whether, and if this was the case, how, the manner in which these two elements were combined made a difference. Another reason for measuring preferences on two occasions was that even if participants would not take part in discussions, their understanding and view of criteria importance could still change after some contemplation. Hence, we set up three groups with different discussion instructions for the period between the elicitation occasions. In group 1, participants did not officially discuss the matter between the first and second elicitation. They were however free to discuss the matter privately with whoever they pleased. In group 2, a teacher-led discussion in class was held regarding the Svartå problem. Participants in group 3 had access to a discussion forum, where they could discuss the problem. They were all somewhat familiar with the Svartå problem, since the problems with the river were familiar topics in the media.

The students were first presented with the decision process approach in class by a researcher. Thereafter, they were provided with user names and passwords, given instructions, and guided to a wiki web site. The web site contained:

1. Background information about the decision problem at hand (the Svartå problem)
2. Information on MCDA and its use for decision making
3. The necessary steps of the decision making process
4. The seven identified criteria (which had been identified by the decision-makers)
5. The seven available alternatives (these had been identified by experts based on different expert reports regarding the problem, see Appendix 2 for a complete description of the alternatives)
6. A link to a discussion forum (where group 3 could discuss the issue at hand between the first and second elicitation)
7. A link to a web application for weight elicitation (the proposed structured, interactive elicitation procedure where continuous instructions guided the user through each stage). The weight elicitation was carried out on two occasions (with one week in between) in order to test whether discussions changed their opinions, and if so, why they changed opinions

A questionnaire was distributed after their participation in order to discover their views on the method, exerted time, reasons for changed preferences, information, suitability of criteria etc. (the questionnaire is included in Appendix 1).

4. Results

The data in relation to attempting to answer these questions come from both log files and the post-test survey. The research question on scalability was mainly addressed by the questionnaire data, but the fact that all students managed to complete the task without much help was also a positive indication. The majority of participants who answered the questionnaire found the tool relatively easy to use. The procedure was completed within a relatively short period of time: 88 per cent of the participants stated that they completed the elicitation within 10 minutes and 98 per cent maintained that the time provided was sufficient.

As for the elicitation method, the first step (to provide a priority order) was considered to be the most difficult on average, whereas the following two steps (setting a scale and adjusting distances) were not considered to be particularly hard. This was in contrast to the politicians in our earlier trial, who found the step of expressing cardinality more difficult. 71 per cent of the students stated that they found the approach of providing strength of preferences regarding evaluation criteria easier, or much easier, than taking a stand in relation to different alternatives. 68 percent stated that they felt very, or pretty, certain about their preferences regarding the criteria and 86 percent found the information about the criteria to be fully or rather sufficient.

The second research question, on decision quality, is much more complicated. It is not something that it is possible to provide a mere yes or no answer. We will therefore present a possible, tentative, answer based on the interpretations of the log data. The analysis includes two aspects that may indicate how "reasoned" or "considered" the answers actually are. The first analysis will deal with the *distribution of preferences*. Considering that all the criteria, for different reasons, have been found to be highly relevant by the decision-makers, it could be argued that extreme values for one or the other criterion may indicate a less considered opinion. The opposite, a balanced rating, would thus indicate more sensitivity to different aspects of the issue. However, which of the criteria are ranked high and which low is also of interest, considering that the students had probably given more thought to some issues (such as bathability) than to others, before participating in this exercise. In relation to the distribution of opinions the ratings of the students will also be compared with that of the elected representatives. If the students' ratings are not dramatically different to those of the politicians, who have been part of a long debate on this issue, this would further indicate that the students are able to answer the questions in a reasonable manner in spite of the relatively short time-period on offer. Secondly, we will analyse *preference stability and change*. One sign of unconsidered preferences, used by opinion researchers, is a marked instability in responses given by the same individuals to the same questions asked on different occasions. Such instability, which owes much to the insubstantiality of the preferences being expressed, can be analysed in relation to group 1 in our sample. However, the information and deliberation that groups 2 and 3 undertook, could potentially lead to reflection and learning. Preference change within these groups may therefore indicate more considered opinions [Luskin et al. 2002].

4.1. The distribution of preferences

The general interpretation of the elicited preferences was performed in a direct way (normalized criteria weights retrieved by mapping the individual weights onto a normalized scale, all weights summing up to 100) in order to easily aggregate the preferences. 90 students took part in the first elicitation occasion, 46 in the second. First of all, the comparison in Table 1 shows that the rankings for both the students and politicians are similar in relation to several respects. The differences in aggregated weights between the highest and lowest ranked criterion are about the same in both groups, indicating that the students considered all the alternatives as seriously as the politicians.

In relation to the rankings of specific criteria, there are some notable differences between the groups. One is that the politicians ranked the criterion "Practicability" much higher than was the case by the students. This could be due to insufficient understanding of the meaning of the criterion among the students. At least, one student commented on this criterion in the questionnaire following the elicitation, and stated that it should be reformulated in order to provide a better understanding in relation to its meaning. The politicians had initially included the criterion due to the political difficulty in carrying out certain measures due to statutory powers, and prioritized it as being relatively high, whereas the students may not really have understood the issues which were involved.

Rank order	**First student ranking (n=90)**	**Average weights**	**Politicians' ranking (n=7)**	**Average weights**
1	Water quality	17.71	Ecological sustainability	17.08
2	Nature/Wildlife	15.53	Water quality	16.31
3	Ecological sustainability	15.37	Practicability	15.92
4	Economy/Costs	14.04	Nature/Wildlife	14.74
5	Impact on existing businesses	13.56	Economy/Costs	13.25
6	Practicability	13.50	Bathability	11.53
7	Bathability	10.28	Impact on existing businesses	11.17

Table 1: Students' first ranking and aggregated weights compared to the politicians'.

The table also shows differences between the groups in relation to the environmentally oriented questions. In both groups the environment is prioritized, but, in the case of the politicians, it is "Ecological sustainability" that is ranked as highest while it is "Water quality" from the students. Perhaps the most interesting result relates to the criterion "Bathability", which the students ranked as the least important. This would be surprising for many politicians, who have assumed that the possibility to bathe in Svartån is the most important aspect for citizens in general and the youth in particular. For instance, this was the very reason for the promise made by one of the politicians to swim in the river. However, water quality was obviously of a higher priority among the students, which does indeed sound reasonable. As the rankings for the two groups was fairly similar overall, it is reasonable to conclude that the distribution of students´ preferences does appear to have been fairly reasoned.

4.2. Preference stability and change

In order to compare the students' preferences between the first and second elicitation, the results for each student were studied individually. Since the elicitation method is graphical and hence imprecise in its design, exact weights between occasions would not be probable – in fact, in practice almost impossible other than by chance – even though the subject had not changed his/her mind. Thus, in this evaluation, the ordinal values of the criteria were studied instead, i.e. the priority orders between occasions were compared, and the results were divided into three groups depending on the absolute rank difference between occasions. No change or an increase or decrease of 1 in rank of a criterion between the priority orders of the two occasions was considered to be an unchanged view (leftmost column in tables 2-4). Moderate changes were those of 2-3 rank positions of a criterion between occasions, whereas dramatic changes were 4-6 shifts in rank of a criterion between occasions. Since the sample was relatively small, no definite conclusions could be drawn from the results, but they can provide an indication as to whether some more changes in priority orders could be seen in the groups where discussions were held.

Do opportunities for deliberation alter the distribution of opinion? Yes, our result suggests that they do. In the control group (group 1), where no official discussions were held, the results between occasions were somewhat more stable than in the discussion groups (although preferences regarding the criterion *Impact on existing businesses*, changed rather significantly - more than half of the participants had changed priorities moderately or dramatically). Changes were predominantly minor between occasions, which indicates a relatively stable elicitation method, as well as preferences among the participants. The students have not responded by random.

In group 3, where participants had access to a discussion forum, preferences regarding the criterion *Ecological sustainability* changed the most. Changes in rank regarding this criterion among participants were almost equally moderate and dramatic (only a third of the participants had unchanged preferences between occasions). This effect could be deduced from discussions in the forum, where most comments were made with regards to this criterion and its importance. Regarding group 3, the criterion *Nature/Wildlife* changed the most as more than half of the group members changed preferences with regards to this criterion. As previously mentioned, the number of participants was relatively low, which makes it difficult to draw definite conclusions regarding changes in preferences, and the reasons for those changes. However, in the questionnaire following both of these occasions, people stated that they changed their views due to an increased understanding of their preferences due to their own thoughts about the criteria, discussions, and/or influence from others. This suggests some relevant learning.

	Change in rank (%)		
Criterion /RD (abs)	**0-1**	**2-3**	**4-6**
Bathability	94.1	0	5.9
Ecological sustainability	70.6	29.4	0
Economy/Costs	70.6	23.5	5.9
Practicability	64.7	23.5	11.8
Nature/Wildlife	58.8	35.3	5.9
Water quality	52.9	41.2	5.9
Impact on existing businesses	47.1	41.2	11.8

Table 2: Changes in rank between occasions for the control group (no discussion).

	Change in rank (%)		
Criterion /RD (abs)	0-1	2-3	4-6
Bathability	78.6	7.1	14.3
Ecological sustainability	35.7	35.7	28.6
Economy/Costs	64.3	35.7	0
Practicability	64.3	28.6	7.1
Nature/Wildlife	64.3	21.4	14.3
Water quality	64.3	35.7	0
Impact on existing businesses	57.1	42.9	0

Table 3: Changes in rank between occasions for Group 2 (discussion in forum).

	Change in rank (%)		
Criterion /RD (abs)	0-1	2-3	4-6
Bathability	73.3	13.3	13.3
Ecological sustainability	60	40	0
Economy/Costs	66.7	26. 7	6.7
Practicability	66.7	26.7	6.7
Nature/Wildlife	46.7	40	13.3
Water quality	60	33.3	6.7
Impact on existing businesses	60	20	20

Table 4: Changes in rank between occasions for Group 3 (discussion in class).

	Average rank changes (%)		
	0-1	**2-3**	**4-6**
Control group	65.5	28.4	6.7
Class discussion	61.9	28.4	9.5
Online discussion	61.2	29.6	9.2

Table 5: Comparing changes (averages in total) between groups

As Table 5 shows, there were only minor differences among the groups in relation to how much they changed their rankings between occasions. The control group exhibits slightly more stable values, but the difference overall is not significant. It is notable, however, that "dramatic" changes (4-6 steps) were 50 per cent more common in the deliberation groups than in the control group. Interestingly, there are virtually no differences between the groups which discussed on-line and that which had class discussions. This indicates that deliberation makes a difference, but the extent of this difference remains uncertain. As it was impossible to prevent discussions within the control group between occasions, there is a possibility that this did take place. It is possible that the difference between the test groups would have been bigger, had this been preventable. However, even if such discussions did not they may have contemplated the issues, holding "internal discussion with themselves". As more than 1/3 of the students changed their views at least a little between occasions – also in the control group – it seems fair to say that a second reflection on an issue does make a difference. Thus, the influence of the specific form of that thinking – alone, in a physical group or on-line – is an issue to be investigated further. How much opinion change stems from discussions in groups versus increased thought and reflection, simply by thinking harder about the issue, is of great theoretical interest and practical importance.

5. Discussion

In many countries, eParticipation has introduced a new element into democratic practices. However, although some promising experimentation is being conducted, research has identified several problems with the existing approaches. While tools of eParticipation are traditionally weak in relation to formal problem modelling, tools developed within decision support and analysis are usually designed for small expert groups. The method tested in this article harnesses the power of both technologies to a new and constructive purpose. The requirements for user input are relaxed and the tool encourages deliberation structured by expert input, in order to facilitate large scale as well as reasoned participation.

The test indicates that the method is easy to use and therefore suitable to scale-up. One could question the participants' representativeness regarding ICT knowledge in general, as they are young and possibly more familiar with the use of such technology. However, the procedural design of the tool employed was relatively simple, and when used by the politicians, there was no difference in relation to the time requirements. The challenge to users (all age groups) is more likely to be related to their understanding of the decision problem at hand, such as, the meaning of the different evaluation criteria and the implications of the available alternatives. In such a short period of time, it is of course impossible for the college students to understand the full implications of all the alternatives to the extent that is possible in relation to the politicians. Even though the students received information about all the

alternatives for the study, it was fairly limited, considering the complexity of the problem to be solved and the fairly invasive nature of some of the measures suggested. We did not test the students' understanding directly, but their actions based on this understanding. In most complex decision making situations, and any decision analysis situation, there is an element of uncertainty involved [French 1995]: nobody can, e.g., exactly define the future impact of an alternative or the exact probabilistic measures ascribed to their possible outcomes. Hence, a lack of complete understanding cannot be an argument against popular participation. The important question is whether the knowledge is sufficient to make a reasoned decision. This was analysed in relation to the distribution of preferences as well as preference stability and change. Overall it was found that the students' opinions were fairly reasoned, but also that the opportunity for deliberation and a second point of measurement made a difference in stabilizing opinions. However, we should bear in mind that the number of participants in this study was relatively small, in particular in the second ranking (n=90 and n=46 respectively), and that the homogeneity of the group is a clear limitation when attempting to make generalizations. Other groups could behave differently and the external validity of the results might be questioned. However, the results did provide an interesting indication and suggested that the study should be replicated with a larger and more representative sample.

In order to conclude; will this method lead to an eParticipation galore? The method per se is indeed a promising candidate for large scale participation. The findings suggest that it is easy to use, understandable and cheap as compared to many other participation tools, such as deliberative discussion forums and citizen panels, which require a great deal of human effort to moderate discussions and the participants' presence over relatively long periods of time. It appears that the method, nonetheless, encourages reasoned opinions, and it provides every user with an equal say, which is a major advantage over e.g. open forums for deliberation. However, the results indicate that the time for reconsideration does indeed matter (all groups changed their views slightly between rating occasions) as do opportunities for deliberation. What difference fuller information and more opportunities for deliberation would make to the distribution of opinions is thus an important question for future research. An even more important aspect is perhaps to analyse the political challenges of implementing this method. As Agre (2002) points out, no significant effects of the adoption are likely to be found if nobody can devise and action a pattern for deploying e-participation in ways that mesh with the gears of existing political institutions. Changes in practice require organizational adaption that goes along with technology adoption, but is this really what our decision makers want? Time after time, governments have adopted e-participation methods that do not interconnect with existing institutions, which they do not intend to change [Åström 2004; Åström and Grönlund 2011]. The question is: will this be different when attempting to extend multi-criteria decision analysis to the public?

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Appendix 1: Questionnaire to students

Circle the alternative you find most fitting.
Only one answer per question.

I go to class: _____

I am (man/woman): _____

1. Did you find it difficult to provide a priority order for the criteria?
Very hard -- Pretty hard -- Not particularly hard -- Not hard at all

2. Did you find it hard to set a scale for the criteria? (to state a value for the least important criteria)
Very hard -- Pretty hard -- Not particularly hard -- Not hard at all

3. Did you find it difficult to adjust the criteria? (i.e. to adjust the distances between them)
Very hard -- Pretty hard -- Not particularly hard -- Not hard at all

4. Do you find it easier or harder to rank and provide strength of preference regarding criteria as opposed to taking a stand on different alternatives?
Much easier -- Easier -- Harder -- Much harder

5. How confident do you feel about your answers (i.e. regarding the priority order and strength of preference of criteria)
Very confident -- Pretty confident -- Not particularly confident -- Not confident at all

6. How confident do you feel about the reliability of the information?
Very confident -- Pretty confident -- Not particularly confident -- Not confident at all

7. Did you change your mind when you weighted the criteria on the second occasion?
Yes, a lot -- Yes, a little -- No, not at all -- Do not remember

8. If you changed your mind, what was the reason? (open answer)

9. Did you find the information about the criteria sufficient?
Fully sufficient -- Rather sufficient -- Rather insufficient -- Completely insufficient

10. Did you find the information about the solutions sufficient?
Fully sufficient -- Rather sufficient -- Rather insufficient -- Completely insufficient

11. How much time did it take to complete the elicitation procedure?
<5 minutes -- 5-10 minutes -- 10-60 minutes -- Over an hour

12. Do you think the time provided to complete the elicitation procedure was sufficient?
Fully sufficient -- Rather sufficient -- Rather insufficient -- Completely insufficient

13. Did you find the criteria suitable, i.e. fitting to use in order to make a decision?
Very suitable -- Rather suitable -- Not particularly suitable -- Not suitable at all

14. Would you like to add or remove any criteria? (open answer)

15. If yes, which one(s)? Why this/these? (open answer)

Appendix 2: Description of the alternatives

Alt. 1 Attend to single sewers

The municipalities' environmental office would continue to make an inventory of single sewers (part of the sewer system had already been invented) and raise the requirements of the land owners with respect to taking care of sewers not fulfilling legal requirements. Priority will be given to the sewers upstream of the city.

Alt. 2 Attend to public sewers

Upstream of the city, there are a number of pump stations and public wastewater purification instalments. They separate impure wastewater into dikes and water bodies within the watershed. The respective instalments' possible effects on the water quality need to be investigated and taken care of.

Alt. 3 Digestion of stable manure and biogas installation

By allowing for stable manure to pass through the digestion chamber of a biogas installation, bacteria will die. From the installation, biogas together with bacteria-free slurry will be taken care of and used as energy production and manure respectively.

Alt. 4 Rain water measures

Measures in order to purify the rain water from bacteria may also decrease the nutrient content, heavy metals content, and petroleum content that travels to the river with rain water.

Alt. 5 Build wetlands

By allowing for drainage water from the surrounding fields to pass through larger wetland areas, the bacteria amount and nutrient content may be reduced. This also opens possibilities for an increase of the ecological multitude in the landscape.

Alt. 6 Attend to livestock farming

Shut out livestock grazing by the watercourse (legislate in order to prohibit farmers to allow grazing closer than a certain number of meters), as well as attend the farmers' treatment of manure.

Alt. 7 Vegetation zones and dikes in the fields

Build vegetation zones along the watercourses and dikes in the landscape. Attend drainage pipes and make them flow into buffering vegetation along the watercourses. At the same time attend the dissemination of manure.