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AN ARGUMENTATION-BASED DESIGN RATIONALE APPLICATION FOR REFLECTIVE PRACTICE

Complete Research

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Abstract

This study presents an argumentation-based design rationale application for supporting communication and reflection in design. The study employs a design science research methodology and contributes to research by investigating the design and evaluation of a software artefact, namely the Rationale Browser. Preliminary evaluation of the software artefact in an experiment indicates its usefulness and usability. We conclude that the artefact can be of particular relevance to both researchers and practitioners, by serving as a reflection and documentation tool in value-sensitive, ethical or reflective design projects.

Keywords: reflective design, value-sensitive design, design rationale, design discourse

1 Introduction

Reflective and value-sensitive approaches play a significant role in information systems (Hirschheim & Klein, 1994; Ulrich, 2001; Yetim, 2010). In recent years, several theoretical approaches and frameworks for supporting value-sensitive designs have been proposed (e.g. Yetim, 2011a; 2011b). Nevertheless, tools that support reflection in value-sensitive design are still rarely used, although many tools have been developed to support communication and reflection in design, in particular tools that implement design rationale methods. Design rationale has a long tradition in dealing with wicked problems. Design rationale systems aim to provide stakeholders with a communication vehicle to support the communication and reasoning behind the design process and facilitate rational judgment of resolutions (MacLean, et al. 1991; Oinas-Kukkonen 1996a; Goldkuhl & Röstlinger; 2009). Additionally, design rationale is capable of enhancing both systems quality and the quality of the entire process (Oinas-Kukkonen, 1996b; 1998a). Thus, design rationale systems appear to be a promising approach for facilitating communication and reflection in the reflective and value-sensitive design and evaluation of systems.

The main objective of our paper is to present the design and evaluation of an argumentation-based design rationale application that implements recent suggestions for reflective and value-sensitive design to accelerate the ethical design and evaluation of systems. Our study was conducted by applying design science research methodology as suggested by Peffers et al. (2007). Thus, the contribution of this paper is the Rationale Browser application, which replicates a previous design rationale model known as QAR and tool known as the Debate Browser (Oinas-Kukkonen, 1996b;

1998a) and integrates into it new ideas from value-sensitive design research (Friedman et al., 2006; Yetim, 2011a; 2011b) for facilitating reflective communication, reasoning and problem comprehension.

In the following, we first present the theoretical background and related works, followed by the methodology, a description of the artefact, its evaluation, discussion and conclusions.

2 Theoretical Background and Related Works

2.1 Reflective Practice

There are several approaches that support user participation and reflection in design and evaluation of information systems (Muller, 2003; Yetim et al., 2012). A few methodologies such as value-sensitive design (Friedman et al. 2006; Yetim, 2011a) pay attention to values, ethics and moral concerns. Reflective research practice is important in dealing with different claims involved in the research in an open and argumentative way (Ulrich, 2001; Yetim, 2010). Reflexive-dialectic argumentation is considered necessary for challenging the dogmatic nature of knowledge and problematizing taken-for-granted meanings, explanations, assumptions and values, and an objective means of resolving problematic situations. Discourse helps to achieve consensus on what is true, good or right.

However, Yetim (2011b) argued that explicit guidance during the participatory process is required in order to enable users to identify a system's motives, methods and outcomes. More specifically, what questions should be asked during design discourse in order to refine a system's actions, goals and underlying values? Yetim (2011b) proposed a framework for systematic reflection, which provides designers with explicit guidelines to deal with pragmatic, ethical and moral issues during the design process and during use. The questions also can guide argumentation during reflective design and evaluation of systems. These questions have not yet been applied in practice, and will be considered in the current work.

The framework of explicit questions is based on the assumption that explicit representations support reasoning and make decisions transparent. Explicit representation can help and guide researchers' reflections and revisions. According to Haynes and Carroll (2010), explicit coordination and rationalization of all the knowledge brought to bear in the development of a working solution is simply beyond the means of any practical design project, and some sort of methodological compromise can be achieved by using concepts and tools drawn from the study of design rationale.

2.2 Design Rationale Approaches

Kunz and Rittel (1970) acknowledged that the design process is a continuous argumentation between stakeholders and proposed Issue-Based Information Systems (IBIS) during the design process. Indeed, they claimed that the argumentative approach is the only way to address wicked design problems. Thereafter, many researchers proposed different methods of facilitating the capture and representation of argumentation for the design process. All of these realizations motivated the development of design rationale (DR).

The main aim of DR is to facilitate the recording and representation of argumentation and reasoning behind the design process (Moran & Carroll, 1996). It could also be seen as a communication vehicle between stakeholders in the knowledge environment and may enhance both target system quality and the quality of process (Oinas-Kukkonen, 1998a). Several studies report the benefits of DR in different domains, including improving the inspection process of software artefacts (Tervonen & Oinas-Kukkonen, 1996), enhancing creativity in a distributed environment (Wang et al., 2013) and so on.

From a holistic viewpoint, approaches to developing design rationale systems may be divided into two major categories, process-oriented and feature-oriented. Typically, the process-oriented approach is

designated as an argumentative approach because it focuses on argumentation for the design process (Regli et al., 2000). Feature-oriented systems typically support the generation of design rationale based on an existing knowledge base (Garcia & Howard, 1992; Myers et al., 1999).

This paper focuses on argumentation-based design rationale. The main aim of argumentation-based design rationale systems is to provide stakeholders with a communication tool to support the rational judgment of resolutions (Goldkuhl & Röstlinger, 2009). The objective is to conceptualize the argumentation process, its structure and elements, and in particular to discover what may be made explicit and what may be assumed understood. Such issues have motivated the development of various design rationale methods (Jarczyk et al., 1992). The roots of the argumentation-based design rationale can be traced back to Toulmin's model of argumentation (1969) and the above-mentioned IBIS method (Kunz & Rittel, 1970). The IBIS model comprises three different nodes (issues, positions and arguments), as well as eight different link types (supports, objects-to, replaces, responds-to, generalizes, specializes, questions and suggested-by). The main difference between these methods is their view about the structure of conceptualization and argumentation and, more precisely, to what extent information behind the design process ought to be recorded and represented (Jarczyk et al., 1992).

Based on observations from various design rationale methods, Oinas-Kukkonen (1996a) proposed the Question-Answer-aRgument (QAR) method to simplify the explicit rhetorical structure of design rationale. The QAR method uses familiar terms such as questions, answers, arguments and decisions to describe the discussion. As shown in Figure 1, nodes, links and hyperdocuments are the basic representations. The discussion is expressed in three types of nodes, namely questions, answers and arguments. Each question expresses the design problems that may have one or more answers. The answers are candidate resolutions to the problem/s, which may consist of one or more supporting or contrary arguments. Likewise, the final answer as an agreed-upon resolution can be marked as a decision. Moreover, the recursive relationship between questions enables one to generalize, specialize or replace design problems with another question. In this way, each separate question may be seen as a hierarchical tree, which can contain child questions, relevant answers and arguments. The questions belong to a hyperdocument that contains a collection of discussions consisting of nodes and links between them (Oinas-Kukkonen, 1996a). In other words, the hyperdocument may serve as a classification schema that provides organizations with a mechanism by which to organize, store and retrieve their design rationale more effectively. There may be various hyperdocuments focusing on different organizational levels, problem domains or a particular activity within a specific project. The terminology used in the QAR method is close to everyday language so that it is understandable and easy to use. Further, hyperdocuments facilitate the growth of the argumentation base in a structured manner that enables organizations to effectively categorize and manage design rationale in different domains on par with other design documents (cf. Oinas-Kukkonen 1997; Oinas-Kukkonen 1998b). The current study considers the QAR method.

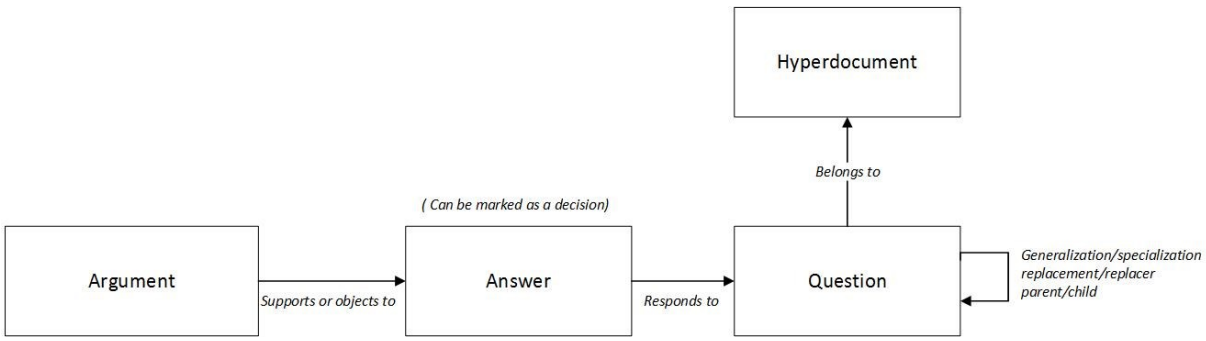

Figure 1. Question-Answer-aRgument (QAR) method (Oinas-Kukkonen, 1996a)

3 Methodology

Various methodological approaches exist for conducting design research. In our research, we employed the design science research methodology (DSRM) suggested by Peffers et al. (2007). The framework contains principles, practices and procedures to guide researchers towards effectively conducting and presenting their design science studies. It involves six sequential activities, namely problem identification and motivation; defining the objectives of a solution; design and development of the artefact; demonstration of the artefact; evaluation of the artefact; and communicating the final results.

We conducted the following activities in our research process. (1) The problem was identified and the need for the designed artefact was motivated through analysis of previous studies. (2) The objective of the solution was that it should act as a vehicle to enable stakeholders to communicate and reason about the actions, goals and values of a system. Moreover, it should facilitate argumentation concerning identifying and checking actions, goals and values from pragmatic, ethical and moral perspectives. (3) The design and development of the Rationale Browser followed software engineering methods and also considered earlier related works. Recent technological frameworks, software design patterns and three-layered software architecture model were utilized during the development phase. (4) The Rationale Browser was demonstrated to some users in an experiment about the ethical evaluation of an imaginary persuasive system. (5) Evaluation of the artefact was conducted at the end of the experimentation period by means of a survey questionnaire. (6) Finally, we communicate our design research process and results in this paper.

The problem definition motivation and objectives have been articulated in the previous sections. The following sections therefore report on the remaining activities, including the design and development, demonstration and evaluation of the designed artefact.

4 Artefact Description: The Rationale Browser

4.1 Motivation and Overview

The *Rationale Browser* as a software artefact was developed to facilitate communication and reflection among different stakeholders in order to promote reflective and value-sensitive design and evaluation of systems. The focus of reflection may include assumptions, actions, goals and underlying implicit and/or explicit values, as well as intended or unintended consequences (Yetim, 2011b). An argumentation-based design rationale application is considered an appropriate way to achieve this objective, as it provides stakeholders with a language for thought and structured communication. In the design of the Rationale Browser, the QAR notation model (Oinas-Kukkonen, 1996a) was chosen as the relevant language, since it uses simple and familiar metaphors to represent the argumentation. It expresses argumentation as a collection of questions, answers and arguments, enabling researchers to effectively capture and represent argumentation in more structured manner. The Rationale Browser tool replicates what the debate browser implemented on top of the QAR method, but also integrates into it new ideas from value-sensitive design for facilitating reflective communication, reasoning and problem comprehension.

The Rationale Browser comprises two main processes, namely capturing and representing argumentation. The application allows stakeholders to effectively pinpoint their views in the form of questions, answers and arguments. The capturing process collects and extracts the rationale behind argumentation and stores it in a rationale repository, while the representation process retrieves information from the rationale repository and visualizes it in a way that brings value for its users.

In the following subsections, we will briefly describe our investigations concerning requirement identification, architectural design and the design of interaction components, and also demonstrate the

functionality of the artefact. Further details of these aspects, as well as other design activities such as modelling behaviours and the design of database, can be found in Haghighatkhah (2013).

4.2 Requirements and System Architecture

The development process started with a formal requirement engineering process in order to identify and formulate essential functional and non-functional requirements for the Rationale Browser. The requirement investigation phase involved continuous information gathering based on previously reported studies, analyses of the problem domain and formulating a requirement specification.

The system has multiple stakeholders, including the systems administrator and end-users. The system administrator must be able to manage basic information, including the creation and modification of hyperdocument collectives and definition of semantic tags, whereas end-users must be able to register and sign in to the accounts and subsequently get involved in a conversation by creating a question or posting an answer or argument. Furthermore, the system must provide users with a capability for searching questions and browsing various hyperdocuments or questions. Lastly, the application must be capable of visualizing argumentation in a hierarchical structure to increase its usability and comprehensibility for users. Figure 2 represents a high-level use case diagram of the system.

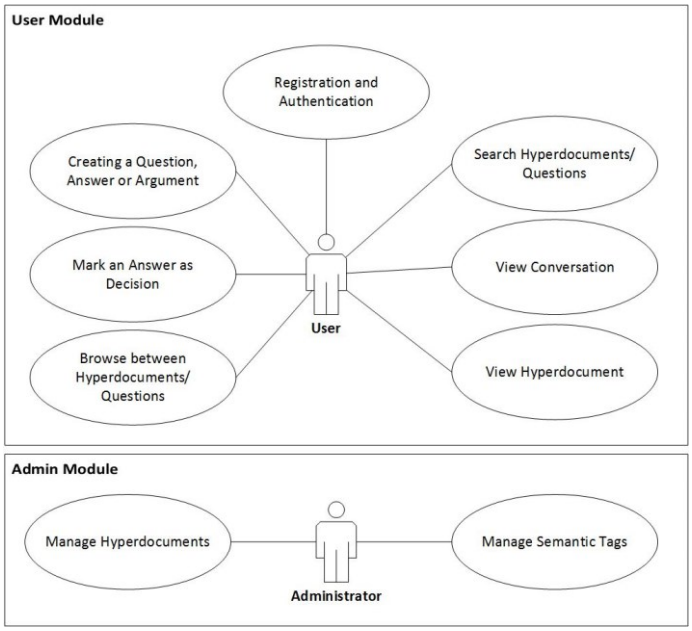

Figure 2. High-level Use Case Diagram

Software architecture is an engineering step from abstraction to realization of systems requirements. The process involves a systematic study of a solution in order to identify its components, their internal interaction and their relationship with the external environment (Clements et al., 2002). To support both functional and non-functional aspects and reduce complexity, we have proposed an architectural design built upon a three-layered architectural model. The model attempts to distribute the complexity of a solution over three distinct layers, namely the web, business and data layers. The workflow starts with a user request to perform a particular task. The system then accepts the request and passes it to the lower layers to perform a sequence of activities. All web components are constructed based on a model, view and controller (MVC) design pattern.

4.3 Design of Interaction Components

In simple terms, software design is an iterative process through which requirements are translated into more tangible design artefacts. This involves the conceptual database design behind the Rationale Browser and the design of components and their interaction. We mainly focus here on the interaction design, which clarifies how the functionality will be provided through web interfaces. During the design process of the Rationale Browser application, mock-ups were designed to clarify how the system will provide users with functionalities through the interfaces. The main aim was to design a minimal user interface and remove all design noises to reduce the cognitive load of interaction between users and the designed web service. The following functionalities were designed to realize the requirements:

- *Authentication Page:* Enables users to easily register and sign in to their account.
- *Home Page:* Comprises three main panels, i.e. a navigation bar, a navigation tree and a workspace. The navigation bar allows users to navigate between different actions, such as home page or search functionalities. The navigation tree lists hyperdocuments, along with their relevant questions, in a hierarchical structure, which enables users to effectively browse different hyperdocuments and questions. The workspace panel is the major working area, which shows different content depending on which hyperlink was clicked by the user.
- *View Conversation:* By selecting a question item in the list (presented in the navigation tree), the user is able to view the entire conversation in QAR format. As the QAR notation model states, an argumentation consists of a particular question, one or many answers and several arguments that may support or contradict a specific answer.
- *Adding Question, Answer or Argument:* Users are able to easily create a new question, provide an answer to a question or make an argument about a particular answer. Clicking on the 'reply' link will lead the user to another page containing a simple form that allows the creation of answers or arguments. Moreover, clicking on the 'create a new question' link will enable the user to create hierarchical questions.
- *Search Hyperdocuments/Questions:* Hyperdocuments and questions are accessible via two approaches: browsing by navigation tree or searching by name or semantic tags.
- *Admin Panel:* The admin page enables system administrators to effectively manage basic information such as hyperdocuments and semantic tags.

4.4 Demonstration

We briefly demonstrate some selected functionalities by means of screenshots.

Navigation Tree Home Page: Once the authentication process is successfully performed, the application redirects the user to the home page, which comprises several panels, including a navigation bar, a navigation tree and a workspace. The navigation tree represents a list of hyperdocuments that contain several discussions. Each hyperdocument aims to classify design rationale elements related to a specific problem domain, project or particular activity. The hierarchical representation of hyperdocuments, along with a collapsible feature, enables users to effectively switch between various problem domains and discussions. Furthermore, clicking on a hyperdocument shows its detailed view (Figure 3), including a list of relevant questions for that hyperdocument. Clicking on the 'new question' link, which is located directly below the description, allows users to create a new question for that hyperdocument.

Conversation View: Once the user clicks on a question represented in the navigation tree, the system redirects him or her to the conversation page. The conversation view page represents a list of rationale

elements (including questions, answers and arguments) in a hierarchical manner (Figure 4). Additionally, a variety of colours have been employed to add more semantic meaning to elements of argumentation (e.g. supporting arguments in green and contrary arguments in red, and the final answer, which serves as decision for the question, in yellow). The user can also switch between a summary and a detailed view of a conversation, as well as creating a new question, supplying a new answer or offering an argument to a particular answer.

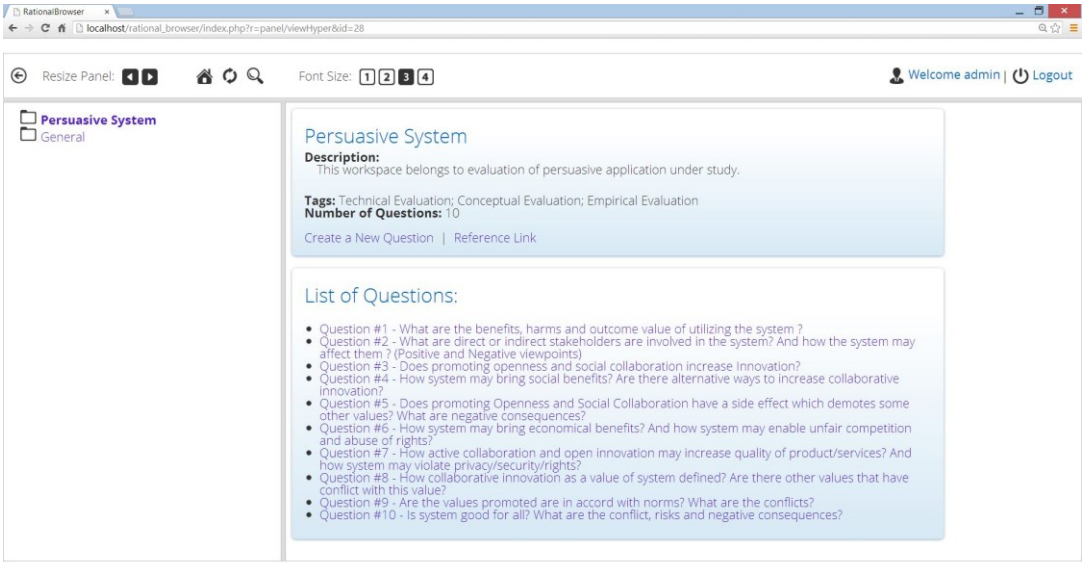

Figure 3. Hyperdocument View

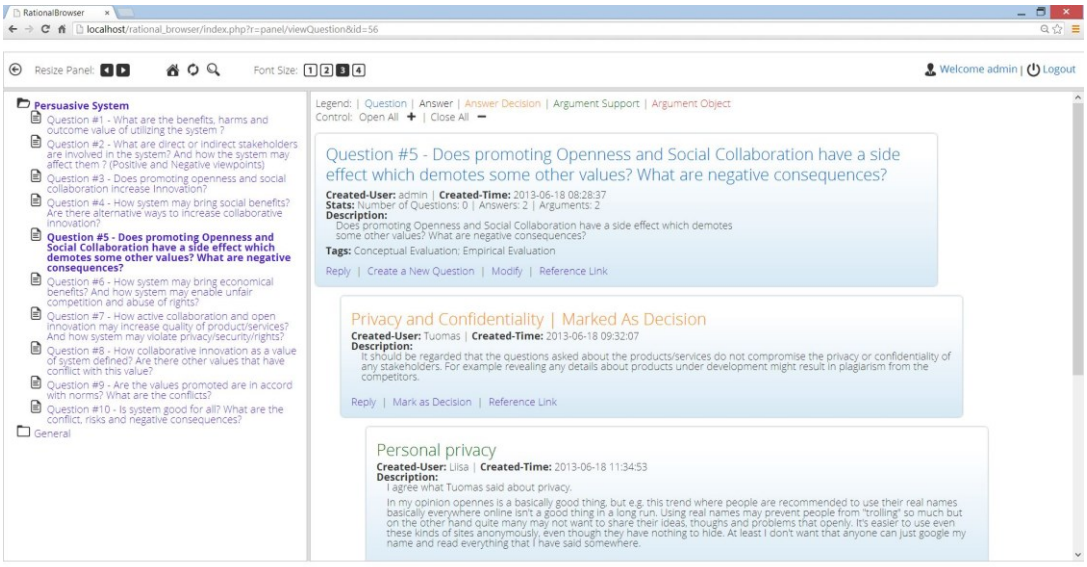

Figure 4. Conversation Page – Detailed View

5 Evaluation

In this section, we describe first the objectives of the evaluation and then the procedure and method of evaluation, including the experiment and participants, and finally we present the results.

5.1 Objectives of the Evaluation

The overall objective of this study was to assess the usefulness of an argumentation-based design rationale application to reflective design. However, a study of the usefulness of a solution comprises an assessment of both utility and usability (Grudin, 1992). Utility refers to the effectiveness of the system's capabilities, whereas usability signifies the ease of use and learnability of a solution (Grudin, 1992).

Given that our study aims to facilitate both communication and reasoning during the argumentation process, the first specific objective was to assess the utility of the Rationale Browser in fulfilling its capacities. The utility assessment involved evaluation of both communication and reasoning capabilities. Moreover, as we were interested in studying the usability of a target solution, the second specific objective was to measure participants' perception and the overall usability of the Rationale Browser. Both aspects play a significant role in the applicability and acceptability of a solution to a particular problem. Moreover, identifying weaknesses and areas of improvement are highly significant in design science research. Such information could potentially increase our understanding in relation to the problem context, and may be used as an input for the next research cycle. Therefore, the third specific objective was to identify open issues and possible opportunities for improvement.

5.2 The Procedure and Method of Evaluation

In accordance with our objectives, we designed and conducted an experiment about a persuasive system (cf. Oinas-Kukkonen & Harjumaa, 2009) and its ethical evaluation. The imaginary persuasive application was defined as an open innovation system that persuades people to collaborate, share and discuss open issues. The main idea behind the system was to encourage firms to utilize external ideas for product development, improvement, research and innovation. For example, different types of bodies, such as public organizations, small businesses and academic institutions, should be able to register freely, open up a problem and ask users to present their resolutions and views. The application employs several persuasive features to encourage use of the system and mutual cooperation and collaboration. The main objective of the system is to increase social innovation and accelerate crowdsourcing procedures (cf. Oinas-Kukkonen & Oinas-Kukkonen, 2013, pp. 123-126).

The experiment lasted five days and was conducted at our research laboratory with six participants, namely two IS researchers and four research assistants. To simulate an actual use environment, participants were divided into three different groups: a technical development team, businesses (customers for the developers) and ordinary end-users of the system. The development team were individuals or groups of people who were actually involved in the design and development of the application under study. The businesses were public or private companies who were directly or indirectly involved or affected by the system. Ordinary end-users were people who use the system to present their views or resolutions.

At the early stages of the experiment, the Rationale Browser application was configured and deployed on a server to be accessed by all users. To facilitate the argumentation process concerning ethical evaluation of the persuasive system under study, we designed ten questions, inspired by the critical heuristics framework for value-sensitive design (Yetim, 2011a; 2011b). Each of these questions was designed with the specific aim of investigating various aspects of ethical conversation on persuasive systems. The following table presents the questions used during the experiment (see Table 1).

During the experiment, participants were asked to stay in their own role, present answers to pre-defined questions and critically argue with other stakeholders. All communication was carried out through the system and the stakeholders were asked to check their own account at least twice a day. The experiment was conducted successfully and all participants actively engaged in online discussion. Moreover, the daily activity of participants was recorded during the experiment, as were bugs and open issues.

Question	**Schedule**
#1 - What are the benefits and harms of utilizing the system?	Day 1
#2 - What are the direct and indirect stakeholders who will be affected by the system? And how the system might affect them?	
#3 - Does promoting openness and social collaboration increase innovation?	Day 2
#4 - How might the system bring social benefits? Are there alternative ways to increase collaborative innovation?	
#5 - Does promoting openness and social collaboration have a side effect that demotes some other values? What are the negative consequences?	Day 3
#6 - How might the system bring economic benefits? And how might the system allow unfair competition and abuse of rights?	
#7 - How might active collaboration and open innovation increase the quality of products/services? And how might the system violate the privacy, security or other rights?	Day 4
#8 - How is the collaborative innovation as a value of the system defined? Are there other values that may come into conflict with this value?	
#9 - Are the values promoted in accord with the accepted norms? What are the conflicts?	Day 5
#10 - Is the system good for all? What are the conflicts, risks and negative consequences?	

Table 1. Questions Used during Experiment

At the end of the experimentation, we designed a small-scale survey to be completed by all participants. The questionnaire comprised of 13 Likert scale questions and one open question to collect users' feedback and suggestions for further improvement. The questionnaire was based on the experiment's objectives and each question aimed to investigate a particular aspect of the solution, including its utility and usability. For example, the questions relevant to the utility assessment were focused on verifying the basic capabilities of the proposed solution. These questions aimed to verify how the solution facilitated communication, reasoning and problem comprehension among stakeholders. The second section of the questionnaire emphasized usability aspects of the system, such as simplicity and ease of use. The last question was open-ended, so as to collect users' feedback and suggestions.

To determine the effectiveness of solution in regard to the aspects described, we used the goal question metric (GQM) method (Basili, 1992). The GQM is a mechanism for evaluating software features. For example, the goal statement explains the ultimate objective of a particular software feature, whereas the question and metric aims to characterize the assessment and achievement of a goal (Basili, 1992).

5.3 Analysis and Presentation of Evaluation Results

5.3.1 Utility Assessment

The utility assessment examines both communication and reasoning capabilities. Communication involves the system's capabilities in providing a communication bridge between stakeholders with conflicting perspectives, whereas reasoning refers to the capabilities for supporting the rational judgment of views.

Elaboration: The application may be seen as a vehicle for communication among stakeholders, which enables them to effectively express their concerns and views in the form of questions, answers and arguments. The QAR notation model behaves as a shared language of communication and thinking among stakeholders and enables the system to effectively capture and represent elements of argumentation in a more structured manner. This may strongly increase mutual understanding and accelerate communication among stakeholders. Furthermore, the hyperlink ability enables stakeholders to attach associative hyperlinks, and, similarly, the parental relationship between questions enables them to specialize, generalize or elaborate issues more simply and effectively. These features may reduce the cognitive complexities of argumentation and facilitate investigation and comprehension of relatively complex issues. Moreover, the solution enables stakeholders to effectively express the reasons behind their views. Each answer as a candidate resolution may contain one or several arguments that either support or contradict it. This is highly likely to encourage critical reflection, reasoning and rational judgment of resolutions.

Analysis: To clarify the effectiveness of the proposed solution in relation to the capabilities already mentioned, we examined the perceived effectiveness of such aspects from the participants' point of view. Table 2 shows the GQM relevant to communication and reasoning capabilities.

Goal	To facilitate communication among various stakeholders with different perspectives To facilitate problem comprehension and investigation To facilitate representation of reasons behind resolutions To facilitate rational judgment of resolutions
Question	Does the system enable stakeholders to present their views and opinions? Does the system facilitate capturing of discussion between stakeholders with different roles? Does the system facilitate navigation between questions and their further investigation? Does the system enable stakeholders to present the reasoning behind their resolutions? Does the system facilitate the rational judgment of resolutions?
Metric	Measured by perceived effectiveness from participants' point of view

Table 2. GQM – Communication and Reasoning Capabilities

Analysis of the survey responses shows that the solution was fairly successful in fulfilling its promises regarding communication and reasoning capabilities. Most of the participants reported that the solution facilitated capturing of discussion among stakeholders with different perspectives. The solution enabled them to effectively present their views and concerns in relation to pre-defined questions. In addition, most of the participants agreed that hierarchical representation of argumentation helped them to effectively navigate between issues, answers and arguments. Moreover, over half of the participants gave positive feedback regarding reasoning capabilities. The solution allowed them to effectively present the reasons behind their views and to rationally assess other resolutions.

5.3.2 Usability Assessment

The usability assessment focuses on the overall system's simplicity and ease of use. There are two major aspects that are very important in this domain, namely the system notation model used during debate and the hierarchical representation of argumentation.

Elaboration: The solution was built upon the QAR notation model. The QAR is a simplified design rationale method that uses debate or discussion as a natural metaphor to represent argumentation. The terminology used in the method is close to everyday language so as to be understandable and easy to use. The QAR notation model is employed as a language of communication both for capturing and representing argumentation. In this sense, the first objective of usability assessment is to evaluate the ease of use and simplicity of the QAR notation model. Furthermore, the application represents elements of argumentation in a hierarchical structure. The conversation page shows selected questions, along with a list of answers and arguments in a hierarchical manner. The collapsible capability enables users to easily switch between the summary and a detailed view of argumentation. The conversation page is one of the major components of the solution. Therefore, the second objective of the usability assessment is to evaluate the ease of use and usefulness of the arguments' hierarchical representation.

Analysis: We examined the perceived usability of these aspects from the participants' point of view. Table 3 shows the GQM relevant to usability aspects of the Rationale Browser.

Goal	System must provide users with an easy to use and simple notation model for capturing argumentation System must provide users with an easy to use and simple approach for representation of argumentation
Question	How was the overall usability of the QAR notation model? How was the overall usability of the hierarchical representation of argumentation?
Metric	Measured by perceived usability from participants' point of view

Table 3. GQM - Usability

The analysis of survey responses revealed that participants rated the overall usability of system high. Most of the participants reported that system notations (question, answer and argument structure) were simple and easy to use. In addition, almost all the participants in the study agreed that the hierarchical view of argumentation was both useful and easy to use.

6 Discussion and Conclusion

The ultimate goal of this study was to assess the usefulness of an argumentation-based design rationale to reflective design. More precisely, we were interested in studying how and to what extent the Rationale Browser application might facilitate the value-sensitive and ethical design and evaluation of systems. The major challenges relevant to the reflective design of systems can be divided into communication, reasoning and problem comprehension issues. The Rationale Browser application was designed to facilitate communication and reflection among stakeholders. The proposed solution can be seen as a discourse support tool that accelerates active argumentation about identifying and checking actions, goals and values.

To evaluate the usefulness of the designed artefact in relation to the research problem, we designed and conducted an experiment, the main objectives of which were to evaluate the utility and usability of the solution and to identify open issues and possible improvements for the next research cycle. The perceived utility and usability from the participants' point of view confirm that the solution establishes

a reflective communication bridge among the parties and enables them to effectively argue and assess the motives behind the target application under evaluation. However, from a practical point of view, there are many other concerns that require additional consideration in future research. We have also identified several problems to be fixed in the next development cycle.

This study is also constrained by several limitations, of which the main ones were the small number of participants and the use of an imaginary persuasive application for the experiment. Therefore, to increase the reliability and validity of the next research cycle, any future experiment should be carried out in an actual use environment with more participants and with a real application under evaluation.

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