Integrated Method for Policy making
using Argument modelling and
Computer assisted Text analysis

FP7-ICT-2009-4 Programme

Grant Agreement Number 247228

Project Start date : 01/01/2010
Project End date : 31/12/2012

Report No. D5.2 – Report on Structured Consultation Tool (SCT)

Version – 1.0

Document prepared by:
Katie Atkinson, Adam Wyner and Trevor Bench-Capon
University of Liverpool

Contributors:
                              5 – University of Liverpool

Deliverable due date: 31.12.2012
Deliverable actual date: 11.01.2013

Document History

Date	Revision	Comments
09/01/12	First draft	For internal discussion at Liverpool
11/01/12	Second draft	Includes updates following internal discussion
17/01/12	Third draft	Includes updates following internal discussion
14/02/12	Sixth draft	Includes updates following internal discussion
14/11/12	Seventh draft	Includes updates for second prototype
19/11/12	Eighth draft	Conversion to doc format with modifications from TBC comments.
28/12/12	Ninth draft	Adding summary contributions, screen shots for SCT, Consultation Instantiation tool, and DB overview.
31/12/12	Tenth draft	TB-C edit
10/01/12	Eleventh draft	AZW reviews edits and ships.
11/01/12	Twelth draft	Review by partners

Participant List

	Short Name	Organisation Name	Country
1	Fraunhofer	Fraunhofer Gesellschaft	Germany
2	ZlG	Zebralog	Germany
3	UvA	University of Amsterdam	Netherlands
4	UnivLeeds	University of Leeds	UK
5	ULIV	University of Liverpool	UK
6	UID	User Interface Design GmbH	Germany

Summary

This document presents the work on the prototypes of the *Structured Consultation Tool (SCT)* of the IMPACT argumentation toolbox. The *SCT* is a tool for constructing and presenting detailed surveys to solicit feedback from the public concerning issues of public policy; the tool is underpinned by a computational model of argumentation that incorporates fine-grained, interconnected argumentation schemes. Research into the appropriate form of, and relationships between, fine-grained argumentation schemes has been undertaken and this has resulted in four schemes being incorpotated in the final prototype. Furthermore, the argumentation schemes analysed have been defined for computational use in terms of a formal, semantic structure, which is also described in this document. The semantic structure serves as a basis upon which the *SCT* has been implemented; we describe the implementation of the tool based on these theoretical foundations. The final prototype has been developed from several disposable, stand alone, proof of concept implementations (e.g. using Prolog, Protege, and a web-interface using PhP/MySQL) intended to clarify particular issues: the final prototype was integrated into the toolbox in close cooperation with UID with the other tools to form the IMPACT argumentation toolbox.

Table of Contents

1 Introduction

This document presents the work on the prototypes of the *Structured Consultation Tool (SCT)* of the IMPACT argumentation toolbox. The *SCT* is a tool for constructing and presenting detailed surveys to solicit feedback from the public concerning issues of public policy; the tool is underpinned by a computational model of argumentation that incorporates fine-grained, interconnected argumentation schemes. Research into the appropriate form of, and relationships between, fine-grained argumentation schemes has been carried out, and has resulted in four approproiate argmentation schemes being used in the final prototype. Furthermore, the argumentation schemes analysed have been defined for computational use in terms of a formal, semantic structure, which is also described in this document. The semantic structure serves as the basis upon which the *SCT* has been implemented; we therefore describe the implementation of the tool based on these theoretical foundations. The final prototype was developed from several disposable, stand alone, proof of concept implementations (e.g. using Prolog, Protege, and a web-interface using PhP/MySQL) intended to clarify particular issues as reported in D5.1: the final prototype was integrated into the toolbox in close cooperation with UID with the other tools to form the IMPACT argumentation toolbox.

2 The *SCT* and the IMPACT Project

The *SCT* is a tool that supports the formation of arguments bearing on policy such as those found in comments on government Green Papers and White Papers and the responses to those comments; the arguments are presented in a form that is suitable for soliciting feedback from the public, thus gathering data on public opinion. In forming arguments, the *SCT* is underpinned by a formal model of argumentation; consequently, complex arguments on policy positions can be systematically assimilated, analysed, evaluated, and justified with computational support. However, participants who respond to the survey component of the tool do not interface with the formal model, but answer questions associated with the model but presented to them in a coherent sequence and in natural language. Thus, while participants can use the tool in a natural and intuitive way, without commitment to, or awareness of, the underlying model, analysts are able to evaluate the data formally, systematically, transparently, and automatically.

One of the central objectives of the *SCT* is to provide a framework in which rich networks of interconnected arguments, using a variety of argumentation schemes, can easily be created, surveyed, analysed, and evaluated. We have analysed and implemented the four argumentation schemes that we see as of central use in policy debates, but any other schemes deemed necessary can be included as desired so long as they are suitably analysed into their relevant component parts. We have found that such additional schemes are typically used to supply further layers of justification for the schemes we have supported. As the *SCT* is designed to import data from the ART and provide data to the AVT, the *SCT* supports the export and import of argumentation scheme elements from and to those tools.

2. Background

Deep conceptual models, which we refer to here as semantic models, have long been advocated as critical for the construction of principled information systems in a particular domain[1]. In our domain of interest, policy deliberations between government officials and interested members of the public, notions of change are fundamental. In general, in a policy deliberation the point is to consider ways of moving from the current situation to one that is more desirable in certain defined respects, where participants act to change situations. Therefore, the crux of the deliberation is about what action to carry out to most improve upon the current situation. For such reasoning, the underlying semantic model must encompass different states of affairs and the causal relationships between them, and the interaction between the choices of the various relevant agents. To underpin deliberation on, and justification of, choice of actions, we provide a semantic structure designed to support reasoning about the actions of groups of agents relevant to a policy debate of the type that can be consulted upon using the *SCT*. We can define our argumentation schemes in terms of this structure, with the central scheme being one intended to support practical reasoning to justify policies. The practical reasoning argumentation scheme is formally expressed in terms of our semantic structure. The context in which the policy is made is then modelled using this semantic structure, and alternative instantiations of the scheme create arguments for and against particular policies that can be presented to the user for critique through the *SCT*. We describe the semantic structure used to underpin the *SCT* and give an example of its instantiation with a relevant policy debate.

---

[1]   See for example: L. T. McCarty. Intelligent legal information systems: problems and prospects. *Rutgers Computer and Technology Law Journal*, 9(2):265–94, 1983.

3 Action-based Alternating Transition Systems

As we discussed in our previous deliverable D5.1, the practical reasoning argumentation scheme is the scheme of central importance to the *SCT* since all policy proposals are based upon a justification of *what to do* on a specific issue. The natural language version of the practical reasoning argumentation scheme[2], which we label PRAS1, is as follows:

> ***In the current circumstances R, we should perform action A, which will result in new circumstances S, realise goal G, and promote a value V.***

This scheme can be viewed as a 'positive' justification in that it proposes an action that would promote some value that is desirable for the agent. PRAS1 can also be stated in a 'negative' version, PRAS2. Where a value is demoted we have a reason to refrain from an action to avoid a state containing particular features (which we continue to call a "goal", although we wish to avoid rather than attain it) that demotes a value. This negative version, which we label PRAS2, is stated as follows:

> ***In the current circumstances R, we should not perform action A, which will avoid new circumstances S, which would realise goal G, which would demotesome value V.***

PRAS2 can thus be used to argue in terms of avoiding some undesirable effect, rather than achieving some positive effect, on our social values, as will be shown in the example that we present in section 4.

Moreover, the practical reasoning argumentation scheme is related to and supported or attacked by other schemes such as the Credible Source argumentation scheme that justifies a statement with reference to a credible source, which in turn may be supported by still other schemes, thus requiring a *network* of interrelated schemes. Many of the schemes are used to justify aspects of the model, rather than reasoning with the model. For now, our focus will be on the practical reasoning scheme: the current implementation supplements this scheme with the Credible Source scheme, to justify factual and causal statements and schemes to justify the consideration, promotion and demotion of values.

To automate reasoning based on the practical reasoning argumentation scheme, the scheme needs to be grounded on some well-defined representation. For this purpose we have chosen an Action-based Alternating Transition System (AATS). AATSs were originally presented as semantic structures for modelling game-like, dynamic, multi-agent systems in which the agents can perform actions in order to modify and attempt to control the system in some way[3]. These structures are thus well suited to serve as the basis for the representation of arguments about action where several different parties may influence the outcome of particular actions. The definition of the components of an AATS is provided in Appendix A.

---

[2]   Note that the specific translation of the natural language version of the scheme into a computational version is dependent upon the language of the formal apparatus used.

[3]   For the origins of AATSs see: M. Wooldridge and W. van der Hoek. On obligations and normative ability: Towards a logical analysis of the social contract. *Journal of Applied Logic*, 3:396–420, 2005.

To represent the practical reasoning argumentation scheme using AATSs, we need to extend the AATS structure to enable the representation of values[4]. The definitions supporting this extension are also given in Appendix A. The extension of the original specification of an AATS to accommodate the notion of values is an *Action-based Alternating Transition System with Values* (AATS+V). Given the AATS+V structure, the practical reasoning argumentation scheme can be expressed in terms of it.

With our formal structure, we can build an AATS+Vs to model our understanding of the relevant policy domain and then generate arguments for and against proposals using the practical reasoning argumentation scheme. The formal machinery using the AATS+V is intended to provide the basis for the specification of semantic models that enable arguments about policy proposals to take place.

Impact scenarios often start from a Green Paper. At this deliberative stage of the process, typically a wide range of proposals is put forward representing the different perspectives of different stakeholders with different expertise, interests and values on the issue. For these to inform policy making, the relevant government Department must analyse them to identify relevant facts, theories, interests and values, trying to synthesise them into some coherent form that can provide the basis of deliberation as to the policy to recommend in the subsequent *White Paper*. A White Paper sets out a concrete policy intended to form the basis of legislation and its justification. Again comments are sought from interested parties on the White Paper, but now with this rather specific focus. In short, when moving from the Green Paper to the White Paper, the government department tries to make sense of the alternative views submitted to try to produce a coherent picture of the domain of interest. Of course, this sense-making is not currently done using a formal apparatus. We argue, however, that such sense-making could be facilitated and supported by formally representing the alternative views as AATS+V models, then reasoning with these models using argumentation schemes. This would clarify the alternative positions on the policy, force reconciliation of any incompatible views, and provide an integrated summary of the consultation. This process was described in deliverable 5.1 and [10].The use of the model has also been described in [1] and [8].

---

[4]   This was done in: K. Atkinson and T. J. M. Bench-Capon. Practical reasoning as presumptive argumentation using action based alternating transition systems. *Artificial Intelligence*, 171(10-15):855–874, 2007.

4 Implementing the Final Prototype of the SCT

This section reports development of the final prototype of the SCT. The first prototype was described in D5.1. This document focusses on the look and feel of the final prototype, and especially on additions and modifications of the first prototype.

We have developed the final prototype based on experiences with the earlier prototypes, consultations with partners about toolbox integration and look-and-feel (UID), data provision from the ART (Amsterdam), and visualisation (Leeds), as well as from feedback from the evaluation (Zebralog). This prototype has been integrated with the other tools in the IMPACT argumentation toolbox.

The final prototype is a development from the earlier prototypes, sharing the main features of SCT screen presentation, code functionality, and DB structure. Some of the main developments that are visible to users of the tool in the toolbox are modifications to the presentation of information to the user, the look and feel, auxiliary argumentation schemes to represent argumentation schemes associated with values, and the end report on the user's input. Only accessible to an expert consultation developer, an additional tool component was created to support the creation of instances of consultations from the components of the argumentation schemes. Finally, to accommodate the auxiliary argumentation schemes, to integrate the SCT into the IMPACT toolbox, and to communicate between the SCT, the ART, and the AVT, modifications were made to the DB and to the PhP code. Each of these topic areas – user interface, consultation instantiation, technical notes and integration – are given a section below along with a sample screen shot, where the full set of screen shots are presented in the appendices. Entity-Relationship diagrams and Data Dictionary are also found in the appendices.

4.1 User Interface in the Toolbox

The sample demonstration of the SCT as it appears in the toolbox is based on an analysis of the LIBER response to the Green Paper consultation on *Copyright in the Knowledge Economy*. The text of the response is as follows:

Question 9. Should the law be clarified with respect to whether the scanning of works held in libraries for the purpose of making their content searchable on the Internet goes beyond the scope of current exceptions to copyright?

Answer: Not all the material digitised by publishers is scanned with OCR (Optical Character Recognition) with the purpose of making the resulting content searchable. If the rights holders will not do this, libraries should be able to offer this service. It would have a transformative effect on research, learning and teaching by opening up a mass of content to users that can be searched using search engines. The interests of copyright holders will not be harmed, because the resulting output will act as marketing material for their materials.

This response was analysed in terms of the argumentation schemes and the computational model of argument [7].

The current implementation of the tool that has been integrated into the IMPACT Project toolbox is visible on:

http://impact.uid.com

The screenshots provide an idea of the flow of the presentation of information to the user as well as responses the user can make. Figure 1 shows an illustrative screen shot from the SCT; a full set of screenshots appear in Appendix C. SCT Prototype Screenshots as Figure 4 to Figure 14. The Figures are discussed further below.

Figure 1 Consequent with Credible Source scheme

From the toolbox introductory page (Figure 4), the user is presented with an SCT introductory screen (Figure 5) that then leads into the subsequent screens for the tool. The pages are in the IMPACT Project toolbox style and fully integrated into the toolbox's functionality. Currently, the user is presented with five screens, one each for an introduction, circumstances, consequences, values, and a summary page. Having completed the use of the tool, users submit their input and return to the toolbox main page. As these pages are intended to be self-explanatory, we only outline the flow and provide auxiliary notes.

The introductory screen (Figure 5) presents the question that is being addressed, the particular policy proposal being considered, and information about how to use the tool and the purpose of the tool. It is optional to enter the user's name. Clicking on the 'Next' button, the user is taken to the next page. In general, the user inputs responses on a page, then moves to the next page by clicking on the 'Next' button. A breadcrumb on the top of the page tracks where the user is in the consultation. While on a page, a user can modify their results, but we have no facility in this prototype to move back to earlier pages to revise previous responses. In addition, there is no facility to interrupt a consultation, move to another tool, and to return to a consultation; in such an instance, the user returns to the very start of the tool and must enter data again.

The consultation has a *main line* and *digressions*. The *main line* of the consultation is structured around the components of the *Practical Reasoning* scheme, including circumstances, consequences, and values. There are *digressions* from each of these main constituents, wherein the user can investigate further the justification for the proposal, then return to the main line. Digressions are structured around the constituents of the relevant argumentation schemes justifying the statement disagreed with. Each proposition in the circumstances and consequences has a digression with respect to the *Credible Source* scheme; each of the values has a digression either with respect to the *Value Credible Source* scheme or the *Value Recognition* scheme. These schemes are discussed further below.

From the introductory screen (Figure 5), the user arrives to the screen for circumstances (Figure 6) that presents the circumstances currently believed to be true. The user is reminded of the question and the proposal, and then given information about how to use the tool. The user can indicate whether they believe that the stated circumstances hold, do not hold or are not applicable using radio buttons. For each proposition among the circumstances that the user believes do not hold or are not applicable, a digression opens using the *Credible Source* scheme. In Figure 7, we show the digression where the user disagrees that "Some material held by publishers is not scanned, so it cannot be searched for". The other links would allow the user to investigate each of the other propositions for the circumstances. The *Credible Source* scheme is a generalisation of several schemes, such as Expert Opinion, Witness Testimony and Position to Know, intended to abstract away from the reason why the source is to be believed, and from whether the source is spoken or written. The genralisation can thus accommodate a range of sources, e.g. newspapers, books, web pages, television, radio, video tapes, and so on. In the prototype the sources are mainly submissions responding to the Green Paper. We have an expert source (LIBER) in a domain (online research), the statement by that source of the

proposition, and the claim that the proposition is from that domain; the proposition is taken as the conclusion of the scheme. For each statement of the *Credible Source* scheme, users can indicate that they agree, disagree, or that the statement is not applicable. Note that while in the main line, the *disagree* and *not applicable* options lead to a digression, no further digressions from within a digression are currently supported, although this in principle is straightforward if suitable supporting arguments for the various components of the Credible Source argument are provided. In this respect, the statements associated with the *Credible Source* scheme appear as leaves of the argument tree. Having addressed all statements concerning circumstances and their associated Credible Source schemes, the user can optionally enter additional information in a free text box. Then the user can progress to the consequences page.

The consequences page (Figure 8 and Figure 10) has the same layout and functionality (digressions using the Credible Source scheme, the text box, and the 'Next' button) as the circumstances page. The information on the page tells users to report whether they accept that indicated propositions are consequences of the proposed action.

From the consequences page, the user goes to the values page (Figure 10 - Figure 12). The page has essentially the same layout and functionality as the circumstances and consequences pages. However, the information on the page tells the user that the values for the action are given default indications; that is, the radio buttons on the page indicate that the party proposing the action holds that the action promotes (or demotes, or is neutral about, or finds not worthwhile) a value. Where the user selects a radio button other than the default, they are given a digression. There are two digressions available to the user. The user might decide that the value differs from the default from amongst promote, neutral, or demote; in this instance the *Value Credible Source* scheme (Figure 11) is used to justify the premise. This scheme is like the *Credible Source* scheme but rather than justifying a circumstances or consequences, which is factual, it justifies a value, which may be a matter of opinion. Again, the user indicates what she finds faulty in the justification. Alternatively, the user might indicate that she finds the value not worthwhile, whereupon the *Value Recognition* scheme (Figure 12) is used; this scheme is a justification that the value is worthwhile given an authority that endorses the value. The user must indicate that either she does not accept the authority or that she does not accept that the authority endorsed the value.

On the closing page (Figure 13 - Figure 14), the user is thanked, given a summary of their input for each section, and a 'Submit' button that records the data to the database and returns the user to the main IMPACT Toolbox page. As a result of the evaluation, it was suggested that on the summary screen, only those statements that were visited be reported, to improve clarity and comprehensibility. This has been changed in the output.

From the evaluation exercise, it was suggested that users be able to alter the structure of the consultation and/or enter free text. Free text comments on each component of the consultation have always been available. A tool, the Argument Critique Tool (ACT) (see [1] and [2]), which is auxiliary to the IMPACT Project, has been developed to allow users to create policy proposals in a structured manner that are

automatically critiqued by the tool. In future such a tool could be used to address this need.

4.2 Consultation Instantiation Tool

The Consultation Instantiation Tool (CIT) enables the user to add and delete elements and relations to the various tables of the Database. It is to be used to construct consultation instances from the components of the DB. As it is only for expert analysts to use, it is only available as a web-link outside the toolbox. This tool is essential for variety of reasons:

1) It allows arguments to be entered directly into the SCT in case this is required for future use cases, or maintenance purposes.
2) It provides a user friendly interface to the database which makes adding and deleting various elements easier.
3) The various tables of the database are displayed in readable format.
4) It provides data in the format required by the SCT should this not otherwise be provided: in particular, instances of the practical argumentation schemes with multiple circumstances, consequences and values.
5) Finally, the CIT enables the creation of new consultations in an easy and straightforward manner. This essential capability is not available in any other tool.

The CIT is divided into 8 different sections (each is separate page), which provide a bottom-up approach to the SCT and the Database, where the primitive elements are first added, then used to build the compound, higher level elements of the tool, such as conjunctions, intermediates, argumentation scheme instances, and the consultation instance. Each section is discussed below. Figure 2 and Figure 3 show illustrative screenshots from the CIT; a full set of screenshots appear in Appendix D. Consultation Instantiation Tool as Figure 15 to Figure 25, which are discussed further below. The screenshots provide an idea of the flow of the presentation of information to the user as well as responses the user can make. On all pages, a menu along the topic of the screen allows the developer to select the relevant table.

3. Intermediates		

4. Practical Reasoning Argumentation Scheme	5. Credible Source Argumentation Scheme

6. Value Recognition Argumentation Scheme	

7. Value Credible Source Argumentation Scheme	8. Consultation

1. Primitives	2. Conjunctions

Agents

ID	Agent	Remove
1	Legislators	delete
2	Libraries	delete

Agent: [   ]

Submit

Actions

ID	Action	Agent	Remove
1	clarify the law.	Legislators	delete
2	scan material.	Libraries	delete

Action: [   ]

Agent: [N/A ⇕]

Submit

Values

ID	Value	Remove
1	Legal clarity	delete
2	Publisher profits	delete
3	Research, learning, and teaching	delete

Figure 2 Consultation Instantiation Primitives part 1

4. Practical Reasoning Argumentation Scheme	5. Credible Source Argumentation Scheme
6. Value Recognition Argumentation Scheme	7. Value Credible Source Argumentation Scheme
8. Consultation	

1. Primitives	2. Conjunctions	3. Intermediates

Proposition Conjunctions

ID	Remove	Propositions
1	delete	Some material held by publishers is not scanned, so it cannot be searched for
		Some material held by publishers is not scanned, so it cannot be used for marketing
		There is no exception to allow libraries to scan materials without seeking permission from the copyright holders
2	delete	All material held by publishers is scanned, so it can be searched for
		All material held by publishers is scanned, so it can be used for marketing
		There is an exception to allow libraries to scan materials without seeking permission from the copyright holders

Propositions

Porposition: N/A

Add Proposition

Submit Propositions   Reset

Values Conjunctions

ID	Remove	Values
3	delete	Research, learning, and teaching - demote
		Publisher profits - neutral
		Legal clarity - promote

Values

Values: N/A

Default Choice: demoted

Add Value

Submit Values   Reset

Figure 3 Consultation Instantiation Conjunctions

In Figure 2 (same as Figure 15), we see the page that allows us to add and delete primitive components of the database. These are:

1) Propositions.
2) Values.
3) Agents.
4) Actions.
5) Domains.
6) Sources.

For the most part, additions are made as text in the text box and without reference to prior data (though see the dropdown box for agents of actions).

At the next level up, as in Figure 3 (same as Figure 17), the user can create new conjunctions of propositions or values. All the input here is dependent on existing data in the Database and is provided by the dropdown menu; for example, conjunctions are constructed from the primitive propositions. The conjunctions can

then be used in to provide circumstances and consequences for new instances of the *Practical Reasoning* scheme.

The user can add any number of propositions (or values) from among the primitives. The user can submit the new conjunction, delete, or reset it at any time. Should the user submit the new conjunction then the various tables of the database are updated accordingly (conjunction and the _occurence tables).

In Figure 18, the intermediates are compound tables constructed as relations of primitive elements. The intermediates provide the user with textual summary of the various intermediate elements in the database and allows the user to add to and delete from the intermediate components of the database. These are:

1) Domain Source – combinations of domains and sources.
2) Source Proposition – combinations of sources and propositions.
3) Domain Proposition – combinations of domains and propositions.

In Figure 20, the user has a textual summary of existing instances of the *Practical Reasoning* scheme. It allows the user to add new instances of the *Practical Reasoning* scheme. New instances are constructed from the various components created using the primitives page (actions) and conjunctions page (circumstances, consequences and values). The user can also delete existing instances from the database. The drop down menus in this page (as well as in other pages) provide textual (rather than numerical IDs) descriptions of the various elements associated with each menu.

In Figure 21, the user has a textual summary of existing instances of the *Credible Source* scheme as well as means to construct new instances of the *Credible Source* scheme from existing primitives (source and domain) and intermediates. The user can also delete existing instances.

In Figure 22, the user has a textual summary of existing instances of the *Value Recognition* scheme as well as means to construct new instances of the *Value Recognition* schemes from existing primitives (source and value). The user can also delete existing instances.

In Figure 22, the user has a textual summary of existing instances of the *Value Credible Source* scheme as well as means to construct new instances of the *Value Credible Source* schemes from existing elements (value, action, source, domain, and relation between value and default). The user can also delete existing instances.

In Figure 24, the user has a textual summary of existing instances of the existing consultations. This comprises (for each consultation): an ID, the ID of the instance of *Practical Reasoning* scheme, and the number of instances of the other schemes associated with the survey. The user can use the details button associated with each consultation to get the full details of the consultation such as shown in Figure 25, which presents a screen shot of the details of the current (live) consultation.

The tool also allows the user to add new consultation. This is done as follows:

1) The user selects an instance of the *Practical Reasoning* scheme; this is the starting point of creating new consultations.
2) The software then displays a list of the instances of the *Credible Source* scheme that support the circumstances of the chosen *Practical Reasoning* scheme instance. The user selects the required instances of the *Credible Source* scheme.
3) The software then displays a list of the instances of the *Credible Source* scheme that support the consequences of the chosen *Practical Reasoning* scheme instance.
4) The software then moves to the values associated with the chosen instance of the *Practical Reasoning* scheme. Firstly the user is presented with a list of the instances of the *Value Credible Source* scheme that support the values promoted by the scheme. Once the user has chosen the desired instances, the software displays the supported instances of the *Value Recognition* scheme.
5) When the user has chosen the various components of the survey, they are presented with an additional information field in which they can fill additional information about the consultation such as title, or running period.
6) When all the components of the consultation are filled the user can click the submit button to add to the new consultation to the database. Note that the user can reset the consultation at any point; and that the various chosen elements are always displayed in details on the right hand side of the page.

4.3 Technical Modifications

In this section, we report technical developments of the current version of the tool from the first prototype, chiefly modifications of the DB (including integration with the ART DB tables), modifications of the web interface (especially of the SQL queries), and modifications to integrate the SCT with the IMPACT Toolbox (including exposing data for the AVT).

The tool is written using PhP and Javascript. The database is written in MySQL. In order to run on a JVM, the PhP code is run under Quercus that successfully copies PhP to the JVM. Thus, no recoding to Java was necessary.

There are two extant versions: a standalone tool SCT 7.2 and the online version for the IMPACT Toolbox on the project weblink (http://impact.uid.com). The latest database version is: impact_uol_uva_db_v1_4. For the discussion here, we focus on relevant aspects of the online SCT tool. Database tables solely relevant to the ART are not discussed in this document.

4.3.1 Database Modifications

A number of improvements and modifications were applied to the existing database. The current version of the database has four different argumentation schemes and an additional occurrence tables as explained below. Overall, the current DB has a more consistent structure than earlier versions:

1) A table was introduced (value_occurrence_default_choice); this links the value_occurrence (i.e. the value used in particular practical reasoning scheme) with its default value in that instance of the scheme. This table was introduced to keep all occurrence tables homogeneous rather than adding the default choice to the value_occurrence table itself.

2) An argumentation scheme was introduced: *Value Credible Source* scheme. This was needed to link the values of the practical reasoning scheme with the values under discussion in the values page (in the consultation) with the source, domain and the action performed. Previously this was ad hoc, using instances of the credible source scheme which was not structured enough.

3) An argumentation scheme was introduced: *Value Recognition* scheme. This was needed to provide a justification if the choice of 'Not Worthwhile' was made with respect to values. This was previously absent in the SCT.

4) For every scheme that is a digression, a new occurrence table for each scheme was introduced. The underlying idea is that a consultation has one instance of the *Practical Reasoning* scheme, but several instances of each of *Credible Source*, *Value Recognition*, and *Value Credible Source* schemes. The consultation references the ID of the conjunction of the schemes as found in the relevant table. was added to the DB for this new scheme which is linked to the consultation table via conjunction.

5) An occurrence table was introduced for values to represent the conjunction of values found in an instance of the *Practical Reasoning* scheme.

6) The DB was cleaned of redundant tables and given the relevant settings.

Multi-lingual support could be developed in principle using additional attributes in the DB. Although we have only implemented full scenarios in English, it would be straightforward to support other languages using our database, although this would, of course, require substantial human effort to supply appropriate and natural sounding translations.

In Appendix E: Data Dictionary we give the data dictionary for the entities in the current version of the MySQL database.

In Appendix F: Entity-Relation Diagrams, we show the entity-relationship diagrams that are generated from the SQL tables. We have an overall diagram followed by several diagrams that focus on particular portions of the tables for Practical Reasoning, Credible Source, and User Responses.

4.3.2 Web Interface Modifications

A number of improvements and modifications were applied to the code for the web interface (PhP, SQL, and Javascript). Some changes improve the query results, while others are concerned with integration:

1) No major changes were applied to the appearance of various web pages of the tool; some of the text displayed was changed, and the redundant proposal page was removed.

2) No major changes were applied to the functionality of the tool: the same arrays and session variables were used to carry information between the various pages. However we have introduced two new schemes for values: *Value Credible Source* and *Value Recognition* schemes (as discussed in the previous section), which affect the way the responses in the values page are generated and displayed.

3) Most of the effort was focused on improving the quality of the SQL queries used in the tool. Previously, the consultation ID was hard coded in most of the queries as well as the database name; this has been changed to use independent

XML Files:
   o   Connection_Vars.xml: contains the elements required to establish connection with the database;
   o   Consultation_Vars.xml: contains the ID of the live consultation.
4) All the SQL queries used in the tool were revised:
   o   The main source for all data used in the tool is the live consultation; the data required to populate the different pages is queried with this in mind, and the SQL queries were modified accordingly.
   o   Previously the tool assumed that the database has one instance of the practical reasoning argumentation scheme; the tool would malfunction should another instance be added to the DB. This is no longer an issue with the new approach that queries the database on the basis of one live consultation.
5) Interaction with AVT: the tool can be queried for the statistics for each component of the practical reasoning scheme as required by the AVT tool. A separate URL can be invoked to generate the JSON with this information. Additional functionality may be desired in the future (for the standalone tool) to query the database for the users responses to other parts of the consultations.

4.3.3 Toolbox Integration Modifications

The toolbox is maintained by the UID partner. Here we mention aspects of the SCT that were modified to accommodate the toolbox requirements.

The SCT has been successfully integrated with the other project tools in the IMPACT Project ToolBox. Previously the SCT ran as an iFrame within the ToolBox, but has now been fully integrated with the ToolBox to support future exploitation plans of the project.

The main difference between the Stand Alone version of the SCT and the Toolbox integrated SCT is that the integrated SCT runs within a division (#div:sct) in the ToolBox: no HTML and BODY tags can be used in this version. Additionally the code of this division has to be generated automatically from the PhP therefore all the HTML functionality has to be produced via echo and print commands within the PhP tags. The last difference is that the navigation process between the pages is different: because the integrated PhP is in effect a dynamic division within the ToolBox, Ajax Calls were used to generate the required actions.

The integration process was achieved as follows:
   1) UID deployed the SCT under separate address to run in the JAVA/glassfish environment.
   2) The latest version of the SCT was debugged to address foreseeable issues arising from running it in the new environment.
   3) A simple API was written for the SCT (SCT.js) following the guidelines provided by UID. This API initialises the tool when the toolbox is loaded by lazy loading the navigation script and attaching the survey styling sheet, survey.css, to the header.
   4) The navigation script was modified to use Ajax calls. Additionally, because of the dynamic nature of the integrated SCT: live was used to bind the functions.

3 Summary of Contributions

- A database for the implementation has been developed that closely relates to the Semantic Model. The database decomposes and modularises the analysis into basic, intermediate, and complex components that can be reused and extended.

- The Expert Testimony scheme has been abstracted to Credible Source, which is used to argue about matters of fact and causation.

- A web-based front-end that queries the database and stores user responses is fully integrated into the IMPACT Project toolbox. This required a range of technical developments.

- A consultation instantiation tool is provided as a web-based interface to the database, allowing all relevant components to be read from and written to the database for the creation of new consultation instances.

- The user interface has been revised as per evaluation studies to make it more useable and accessible.

- Two new subsidiary argumentation schemes are introduced and used - the Value Credible Source scheme and the Value Recognition scheme. These schemes make use components of the database already introduced, thereby linking the use of the schemes to other schemes.

- The Structured Consultation Tool has also been integrated with the other Impact tools in the toolbox in the sense that: data written into the homongenised database by the Argument Reconstruction Tool can be read by the Structured Consultation Tool; data gathered by the Structured Consultation Tool, e.g. user input to the consultation, can be read by the Argument Visualisation Tool. This suffices to provide full intergration from the user perspective.

List of Publications

[1] Adam Wyner, Maya Wardeh, Trevor Bench-Capon, and Katie Atkinson. A model-based critique tool for policy deliberation. In Proceedings of 25th International Conference on Legal Knowledge and Information Systems (JURIX 2012), pages 167–176, 2012. IOS Press.

[2] Adam Wyner, Katie Atkinson, and Trevor Bench-Capon. Model based critique of policy proposals. In Proceedings of the 4th International Conference on eParticipation (ePart 2012), pages 120–131, 2012.

[3] Adam Wyner, Jodi Schneider, Katie Atkinson, and Trevor Bench-Capon. Semi-automated argumentative analysis of online product reviews. In Proceedings of the 4th International Conference on Computational Models of Argument (COMMA 2012), pages 43–50, 2012.

[4] Adam Wyner, Katie Atkinson, and Trevor Bench-Capon. Critiquing justifications for action using a semantic model: a demonstration. In Proceedings of the 4th International Conference on Computational Models of Argument (COMMA 2012), pages 503–504, 2012.

[5] Adam Wyner, Katie Atkinson, and Trevor Bench-Capon. A functional perspective on argumentation schemes. In Proceedings of the 9th International Workshop on Argumentation in Multi-Agent Systems (ArgMAS 2012), pages 203–222, 2012.

[6] Adam Wyner and Jodi Schneider. Arguing from a point of view. In Proceedings of the 1st International Conference on Agreement Technologies, pages 153–167, 2012. Katie Atkinson, Trevor Bench-Capon, and Adam Wyner. Opinion gathering using a multi-agent systems approach to policy selection. In Proceedings of the 11th International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS 2012), pages 1171–1172, 2012.

[7] Sarah Pulfrey-Taylor, Emily Henthorn, Katie Atkinson, Adam Wyner, and Trevor Bench-Capon. Populating a semantic model for an argumentation-based consultation tool. In Proceedings of the 24th International Conference on Legal Knowledge and Information Systems. JURIX 2011, pages 150–154, Amsterdam, 2011. IOS Press.

[8] Adam Wyner, Katie Atkinson, and Trevor Bench-Capon. Towards a structured online consultation tool. In Electronic Participation - Third International Conference (ePart 2011), volume 6847 of Lecture Notes in Computer Science (LNCS), pages 286–297, Berlin, Germany, August 2011. Springer.

[9] Adam Wyner, Trevor Bench-Capon, and Katie Atkinson. Towards formalising argumentation about legal cases. In Proceedings of the 13th International Conference on Artificial Intelligence and Law (ICAIL 2011), pages 1–10, Pittsburgh, PA, USA, 2011.

[10] Katie Atkinson, Trevor Bench-Capon, Dan Cartwright, and Adam Wyner.

Semantic models for policy deliberation. In Proceedings of the 13th International Conference on Artificial Intelligence and Law (ICAIL 2011), pages 81–90, Pittsburgh, PA, USA, 2011.

Appendix A. AATS+V Definitions

An *Action-based Alternating Transition System* (AATS) is an $(n + 7)$-tuple $S = \langle Q,$ $q_0, Ag, Ac_1, \ldots, Ac_n, \rho, \tau, \Phi, \pi \rangle$, where:

• Q is a finite, non-empty set of *states*;

• $q_0 \in Q$ is the *initial state*;

• $Ag = \{1,\ldots,n\}$ is a finite, non-empty set of *agents*;

• Ac_i is a finite, non-empty set of actions, for each $i \in Ag$ where $Ac_i \cap Ac_j = \varnothing$; for all $i \neq j \in Ag$;

• $\rho: Ac_{Ag} \to 2^Q$ is an *action pre-condition function*, which for each action $\alpha \in Ac_{Ag}$ defines the set of states $\rho(\alpha)$ from which α may be executed;

• $\tau : Q \cdot J_{Ag} \to Q$ is a partial *system transition function*, which defines the state $\tau(q, j)$ that would result by the performance of j from state q – note that, as this function is partial, not all joint actions are possible in all states (cf. the pre-condition function above);

• Φ is a finite, non-empty set of *atomic propositions*; and

• $\pi : Q \to 2^\pi$ is an *interpretation function*, which gives the set of primitive propositions satisfied in each state: if $p \in \pi(q)$, then this means that the propositional variable p is satisfied (equivalently, true) in state q.

AATSs are particularly concerned with the joint actions of the set of agents. j_{Ag} is the joint action of the set of k agents Ag, and is a tuple $\langle \alpha_1,\ldots,\alpha_k \rangle$, where for each α_j (where $j'' k$) there is some $i \in Ag$ such that $\alpha_j \in Ac_i$. Moreover, there are no two different actions α_j and $\alpha_{j'}$ in j_{Ag} that belong to the same Ac_i. The set of all joint actions for the set of agents Ag is denoted by J_{Ag}, so $J_{ag} = \Pi_{i \in Av} Ac_i$. Given an element j of J_{Ag} and an agent $i \in Ag$, i's action in j is denoted by j_i.

To represent the practical reasoning argumentation scheme using AATSs, we need to extend the AATS structure to enable the representation of values[5]. We introduce a set V of values. As given by ™, every transition between two states either promotes, demotes, or is neutral with respect to each value. Additionally, some actions promote or demote values by their very performance. This is captured using the function ε.

• V is a finite, non-empty set of values.

• ™ $: Q \cdot Q \cdot V \to \{+, -, =\}$ is a *valuation function* which defines the status (promoted ($+$), demoted ($-$) or neutral ($=$)) of a value $v_u \in V$ ascribed to the transition between two states: (q_x, q_y, v_u) labels the transition between q_x and q_y with one of $\{+, -, =\}$

---

5   This was done in: K. Atkinson and T. J. M. Bench-Capon. Practical reasoning as presumptive argumentation using action based alternating transition systems. *Artificial Intelligence*, 171(10-15):855–874, 2007.

with respect to the value $v_u \in V$.

- $\varepsilon : J \cdot V \to \{+, -, =\}$ is a *valuation function* which defines the status (promoted (+), demoted (–) or neutral (=)) of a value $v \in V$ ascribed to performance of an action: $\varepsilon(j_x, v_y)$ labels the transition made using j_x with one of $\{+, -, =\}$ with respect to the value $v_y \in V$.

The extension of the original specification of an AATS to accommodate the notion of values is an *Action-based Alternating Transition System with Values* (AATS+V), defined as a $(n + 10)$ tuple $S = \langle Q, q_0, Ag, Ac_1, \dots, Ac_n, \rho, \tau, \Phi, \pi, V, ^{TM}, \varepsilon \rangle$.

Given the AATS+V structure, we re-state PRAS1 in terms of it (PRAS2 is similar). This gives us:
PRAS1 (restated)

The initial state $q_0 = q_x \in Q$,
Agent $i \in Ag$ should participate in joint action $j \in J_{Ag}$ where $j_i = \alpha_i$,
Such that $\tau(q_x, j)$ is q_y,
Such that $p_a \in \pi(q_y)$ and $p_a \notin \pi(q_x)$,
Such that for some $vu \quad V, \delta(q_x, q_y, v_u)$ is + or $\varepsilon(j, v_u)$ is +.

Appendix B. AATS+V Example from Green Paper

In [10] we presented a fully worked example to demonstrate how a policy debate can be represented in terms of AATS+V models from which we can generate practical arguments to be delivered in surveys in the SCT. This hand-crafted example was presented so as to comprehensively show how our formal apparatus can be applied to the task in hand. However, we have also applied our approach using responses to the Green Paper consultation on "Copyright in the Knowledge Economy"[6], as is being used in the IMPACT project. Here we present an example to show how an AATS+V model can be constructed from an actual response from the corpus.

It is not within the remit of the SCT to support the move from natural language to computational arguments. However, as a case study of the analytic process involved in making this move, two intern students (see [7]) worked on this task to produce an instantiated AATS+V model from the following excerpt from one of the Green Paper responses[7]:

Question 9. Should the law be clarified with respect to whether the scanning of works held in libraries for the purpose of making their content searchable on the Internet goes beyond the scope of current exceptions to copyright?

Answer: Not all the material digitised by publishers is scanned with OCR (Optical Character Recognition) with the purpose of making the resulting content searchable. If the rights holders will not do this, libraries should be able to offer this service. It would have a transformative effect on research, learning and teaching by opening up

---

[6]   http://ec.europa.eu/internal_market/copyright/docs/copyright-infso/greenpaper_en.pdf
[7]   This particular text is an excerpt taken from a response from the Association of European Research Libraries.

a mass of content to users which can be searched using search engines. The interests of copyright holders will not be harmed, because the resulting output will act as marketing material for their materials.

The passage was analysed in terms of the PRAS with reference to the AATS+V model. The analysts made each instantiation of an argumentation scheme discrete and self-contained; for example, where two (or more) actions lead to the same consequences, analysts provided two instantiations of the scheme. To represent the knowledge of the passage and adhere to the formal semantic model, implications and assumptions are made explicit in the formal expression such as causal implications, relevant circumstances or consequences, values associated with agents' priorities and interests, or the introduction of agents, actions, and joint action. These can then be used in the survey. A sample of the analysis is[8]:

- Current Circumstance (q_1)
  - The law is unclear as to whether libraries are legally allowed to digitise and make Internet searchable those materials in their collections that the copyright holders do not digitise and make searchable. ($\leftarrow a$)
  - No increased marketing for copyright holders' materials. ($\leftarrow b$)
  - Not all material is digitised and made Internet searchable. ($\leftarrow c$)
- Joint Action (j_1) of Ac_i and Ac_j
  - Legislators clarify the law so that libraries are able to digitise works they hold for the purpose of making content Internet searchable (Ac_i)
  - Libraries digitise the works they hold and make them Internet searchable (Ac_j)
- Agents
  - Legislators (ag_l)
  - Librarians (ag_j)
- Consequences (q_2)
  - The law is clarified, legally allowing libraries to digitise and make Internet searchable those materials in their collections that the copyright holders do not digitise and make searchable. (a)
  - Increased marketing for copyright holders' materials. (b)
  - All material is digitised and made Internet searchable. (c)
- Goal
  - All material is digitised and made Internet searchable. (c)
- Values Promoted
  - Open access to research (v_s)
  - Balance interests of different parties (v_t)
- Values Demoted
  - None as the copyright holders' interests are helped by c. (Note that this does not appear in the PRAS argument but is available as a Credible Source rebuttal to the objection that copyright holders' interests (v_t) will be demoted).

Given instantiated arguments, we can then select an argument to feed into the *SCT* for

---

[8] q_1 and q_2 are states; *a*, *b*, and *c* are propositional variables; Ac_i and Ac_j are agents' actions; j_1 is a joint action, ag_l and ag_j are agents; and v_s and v_t are values.

presentation online to the public, as described previously in the deliverable[9].

Appendix C. SCT Prototype Screenshots
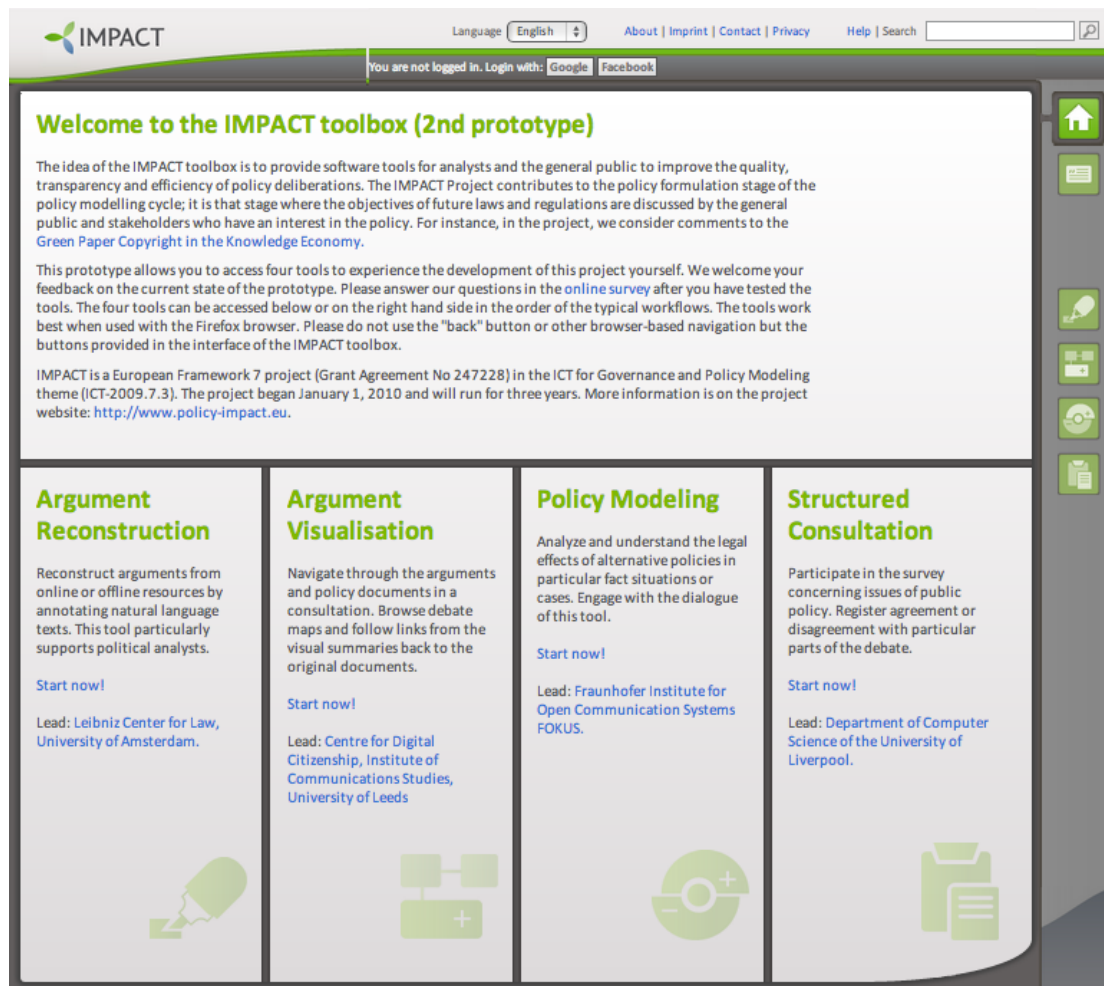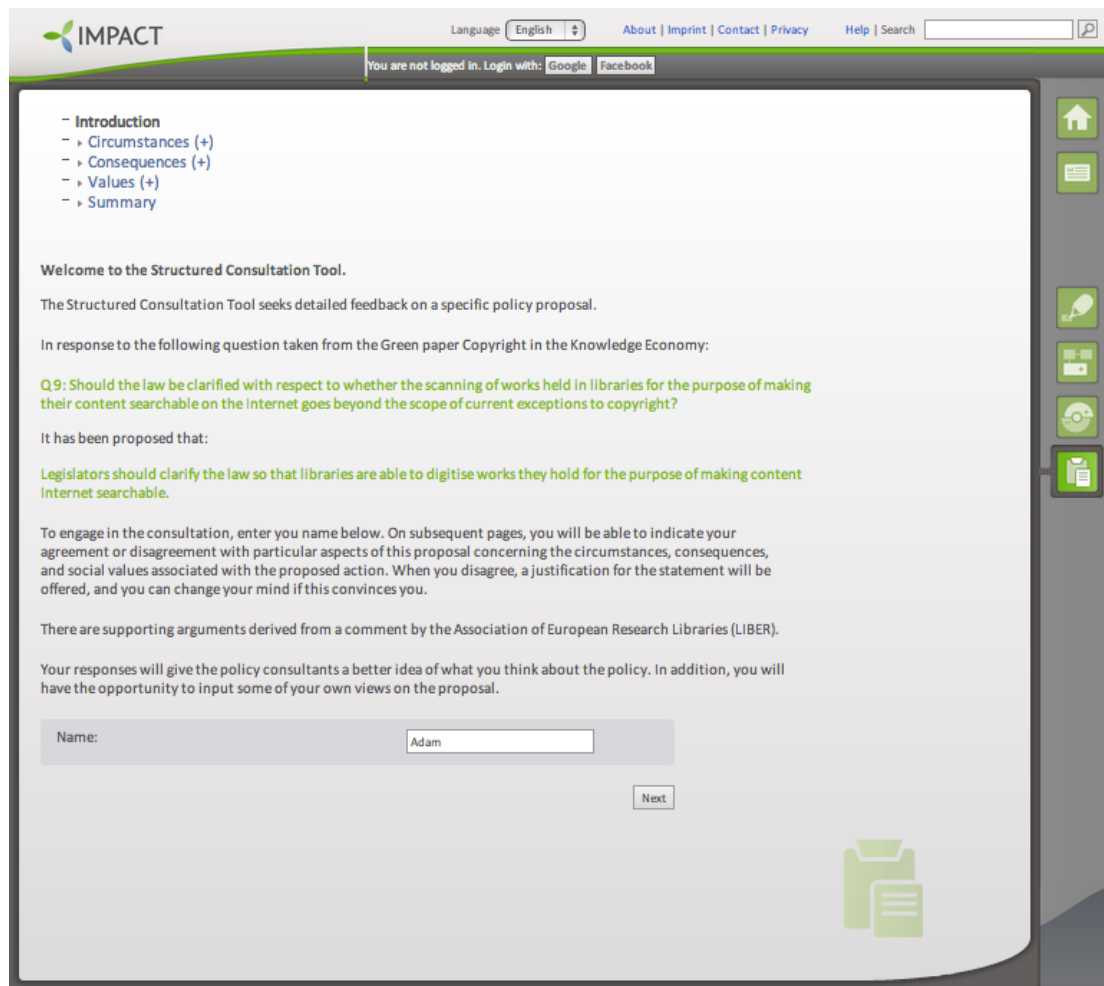
Figure 4 Introduction to IMPACT Project Toolbox

Figure 5 Introduction to SCT tool

Figure 6 Circumstance page with defaults

Figure 7 Circumstance page with Credible Source Digression

Figure 8 Consequence page with defaults

Figure 9 Consequence page with Credible Source Digression

Figure 10 Value Page with defaults

Figure 11 Value page with Value Credible Source Digression

Figure 12 Value page with Value Recognition Digression

Figure 13 Summary page part one

Figure 14 Summary page part 2

Appendix D. Consultation Instantiation Tool

3. Intermediates	
4. Practical Reasoning Argumentation Scheme	5. Credible Source Argumentation Scheme
6. Value Recognition Argumentation Scheme	
7. Value Credible Source Argumentation Scheme	8. Consultation
1. Primitives	2. Conjunctions

Agents

ID	Agent	Remove
1	Legislators	delete
2	Libraries	delete

Agent: [   ]

Submit

Actions

ID	Action	Agent	Remove
1	clarify the law.	Legislators	delete
2	scan material.	Libraries	delete

Action: [   ]

Agent: [N/A ▼]

Submit

Values

ID	Value	Remove
1	Legal clarity	delete
2	Publisher profits	delete
3	Research, learning, and teaching	delete

Figure 15 Consultation Instantiation Primitives part 1

Propositions

ID	Proposition	Remove
1	Some material held by publishers is not scanned, so it cannot be searched for	delete
2	Some material held by publishers is not scanned, so it cannot be used for marketing	delete
3	There is no exception to allow libraries to scan materials without seeking permission from the copyright holders	delete
4	All material held by publishers is scanned, so it can be searched for	delete
5	All material held by publishers is scanned, so it can be used for marketing	delete
6	There is an exception to allow libraries to scan materials without seeking permission from the copyright holders	delete
7	Clarifying the law demotes legal clarity	delete
8	Clarifying the law is neutral to publisher profits	delete
9	Clarifying the law promotes research, learning, and teaching	delete

Proposition: [   ]

Submit

Domains

ID	Domain	Remove
1	online research	delete
2	government information	delete
3	publishers information	delete

Domain Name: [   ]

Submit

Sources

ID	Source	Remove
5	LIBER	delete

Source Name: [   ]

Submit

Figure 16 Consultation Instantiation Primitives part 2

4. Practical Reasoning Argumentation Scheme	5. Credible Source Argumentation Scheme
6. Value Recognition Argumentation Scheme	7. Value Credible Source Argumentation Scheme
8. Consultation	

1. Primitives	2. Conjunctions	3. Intermediates

Proposition Conjunctions

ID	Remove	Propositions
1	delete	Some material held by publishers is not scanned, so it cannot be searched for
		Some material held by publishers is not scanned, so it cannot be used for marketing
		There is no exception to allow libraries to scan materials without seeking permission from the copyright holders
2	delete	All material held by publishers is scanned, so it can be searched for
		All material held by publishers is scanned, so it can be used for marketing
		There is an exception to allow libraries to scan materials without seeking permission from the copyright holders

Propositions

Porposition: [N/A ▼]

[Add Proposition]

[Submit Propositions] [Reset]

Values Conjunctions

ID	Remove	Values
3	delete	Research, learning, and teaching - demote
		Publisher profits - neutral
		Legal clarity - promote

Values

Values: [N/A ▼]

Default Choice: [demoted ▼]

[Add Value]

[Submit Values] [Reset]

Figure 17 Consultation Instantiation Conjunctions

4. Practical Reasoning Argumentation Scheme		5. Credible Source Argumentation Scheme	
6. Value Recognition Argumentation Scheme		7. Value Credible Source Argumentation Scheme	
8. Consultation			
1. Primitives	2. Conjunctions		3. Intermediates

Domain Source

ID	Proposition	Domain	Remove
10	online research	LIBER	delete
11	online research	LIBER	delete
12	online research	LIBER	delete
13	online research	LIBER	delete
14	online research	LIBER	delete
15	online research	LIBER	delete
16	online research	LIBER	delete
17	online research	LIBER	delete
18	online research	LIBER	delete

New Domain Source

Domain: N/A

Source: N/A

Submit

Source Proposition

ID	Proposition	Domain	Remove
10	Some material held by publishers is not scanned, so it cannot be searched for	LIBER	delete
11	Some material held by publishers is not scanned, so it cannot be used for marketing	LIBER	delete
12	There is no exception to allow libraries to scan materials without seeking permission from the copyright holders	LIBER	delete
13	All material held by publishers is scanned, so it can be searched for	LIBER	delete
14	All material held by publishers is scanned, so it can be used for marketing	LIBER	delete
15	There is an exception to allow libraries to scan materials without seeking permission from the copyright holders	LIBER	delete
16	Clarifying the law demotes legal clarity	LIBER	delete
17	Clarifying the law is neutral to publisher profits	LIBER	delete
18	Clarifying the law promotes research, learning, and teaching	LIBER	delete

New Source Proposition

Proposition: N/A

Source: N/A

Submit

Figure 18 Consultation Instantiation Intermediates part 1

Domain Proposition

ID	Proposition	Domain	Remove
1	Some material held by publishers is not scanned, so it cannot be searched for	online research	delete
10	Some material held by publishers is not scanned, so it cannot be searched for	online research	delete
2	Some material held by publishers is not scanned, so it cannot be used for marketing	online research	delete
11	Some material held by publishers is not scanned, so it cannot be used for marketing	online research	delete
3	There is no exception to allow libraries to scan materials without seeking permission from the copyright holders	online research	delete
12	There is no exception to allow libraries to scan materials without seeking permission from the copyright holders	online research	delete
13	All material held by publishers is scanned, so it can be searched for	online research	delete
14	All material held by publishers is scanned, so it can be used for marketing	online research	delete
15	There is an exception to allow libraries to scan materials without seeking permission from the copyright holders	online research	delete
16	Clarifying the law demotes legal clarity	online research	delete
17	Clarifying the law is neutral to publisher profits	online research	delete
18	Clarifying the law promotes research, learning, and teaching	online research	delete
4	All material held by publishers is scanned, so it can be searched for	government information	delete
5	All material held by publishers is scanned, so it can be used for marketing	government information	delete
6	There is an exception to allow libraries to scan materials without seeking permission from the copyright holders	government information	delete
7	Clarifying the law demotes legal clarity	publishers information	delete
8	Clarifying the law is neutral to publisher profits	publishers information	delete
9	Clarifying the law promotes research, learning, and teaching	publishers information	delete

New Domain Proposition

Proposition: N/A

Domain: N/A

Submit

Figure 19 Consultation Instantiation Intermediates part 2

1. Primitives	2. Conjunctions	3. Intermediates
6. Value Recognition Argumentation Scheme		7. Value Credible Source Argumentation Scheme
8. Consultation		
4. Practical Reasoning Argumentation Scheme		5. Credible Source Argumentation Scheme

Practical Reasoning Scheme Instantiations

ID	Circumstances	Action	Agent	Consequences	Values	Remove
1	Some material held by publishers is not scanned, so it cannot be searched for - Some material held by publishers is not scanned, so it cannot be used for marketing - There is no exception to allow libraries to scan materials without seeking permission from the copyright holders -	clarify the law.	Legislators	All material held by publishers is scanned, so it can be searched for - All material held by publishers is scanned, so it can be used for marketing - There is an exception to allow libraries to scan materials without seeking permission from the copyright holders -	Research, learning, and teaching - Publisher profits - Legal clarity -	delete

New Practical Reasoning Scheme Instance

Cicumstances:
N/A

Action: N/A

Consequences:
N/A

Value: N/A

Add

Figure 20 Consultation Instantiation Practical Reasoning Scheme

1. Primitives		2. Conjunctions		3. Intermediates
6. Value Recognition Argumentation Scheme			7. Value Credible Source Argumentation Scheme	
		8. Consultation		
4. Practical Reasoning Argumentation Scheme			5. Credible Source Argumentation Scheme	

Credible Source Scheme Instances

ID	Source	Expert in Domain	Source Proposition	Domain Proposition	
10	LIBER	online research	Some material held by publishers is not scanned, so it cannot be searched for	Some material held by publishers is not scanned, so it cannot be searched for	delete
11	LIBER	online research	Some material held by publishers is not scanned, so it cannot be used for marketing	Some material held by publishers is not scanned, so it cannot be used for marketing	delete
12	LIBER	online research	There is no exception to allow libraries to scan materials without seeking permission from the copyright holders	There is no exception to allow libraries to scan materials without seeking permission from the copyright holders	delete
13	LIBER	online research	All material held by publishers is scanned, so it can be searched for	All material held by publishers is scanned, so it can be searched for	delete
14	LIBER	online research	All material held by publishers is scanned, so it can be used for marketing	All material held by publishers is scanned, so it can be used for marketing	delete
15	LIBER	online research	There is an exception to allow libraries to scan materials without seeking permission from the copyright holders	There is an exception to allow libraries to scan materials without seeking permission from the copyright holders	delete
16	LIBER	online research	Clarifying the law demotes legal clarity	Clarifying the law demotes legal clarity	delete
17	LIBER	online research	Clarifying the law is neutral to publisher profits	Clarifying the law is neutral to publisher profits	delete
18	LIBER	online research	Clarifying the law promotes research, learning, and teaching	Clarifying the law promotes research, learning, and teaching	delete

New Credible Source Scheme

Source: [N/A]

Expert in Domain: [N/A]

Source Proposition: [N/A]

Domain Proposition: [N/A]

[Add]

Figure 21 Consultation Instantiation Credible Source Scheme

1. Primitives		2. Conjunctions		3. Intermediates
4. Practical Reasoning Argumentation Scheme			5. Credible Source Argumentation Scheme	
		8. Consultation		
6. Value Recognition Argumentation Scheme			7. Value Credible Source Argumentation Scheme	

Value Recognition Argumentation Schemes

ID	Value	Source	Remove
4	Legal clarity	LIBER	delete
5	Publisher profits	LIBER	delete
6	Research, learning, and teaching	LIBER	delete

New Value Recognition Argumentation Scheme Instance

Value: [N/A]

Expert: [N/A]

[Submit]

Figure 22 Consultation Instantiation Value Recognition Scheme

1. Primitives		2. Conjunctions		3. Intermediates
4. Practical Reasoning Argumentation Scheme			5. Credible Source Argumentation Scheme	
		8. Consultation		
6. Value Recognition Argumentation Scheme			**7. Value Credible Source Argumentation Scheme**	

Credible Source Schemes

ID	Source	Expert in Domain	Value	Default Choice	Action	
1	LIBER	online research	Research, learning, and teaching	demote	clarify the law.	delete
2	LIBER	online research	Publisher profits	neutral	clarify the law.	delete
3	LIBER	online research	Legal clarity	promote	clarify the law.	delete

New Value Credible Source Scheme Instance

Source: [N/A]

Expert in Domain: [N/A]

Says that Action: [N/A]

Relates to Value: [N/A]

[Add]

Figure 23 Consultation Instantiation Value Credible Source Scheme

1. Primitives		2. Conjunctions		3. Intermediates
4. Practical Reasoning Argumentation Scheme			5. Credible Source Argumentation Scheme	
6. Value Recognition Argumentation Scheme			7. Value Credible Source Argumentation Scheme	
		8. Consultation		

Consultations

ID	Consultation Information	Practical Reasoning Scheme	Credible Source Schemes	Value Credible Source Schemes	Value Recognition Schemes	Remove	Details
4	Consultation LIBER	1	6	3	3	delete	details

Add New Consultation

Practical Reasoning Scheme

ID	Select		Description
1	Select	Circumstances	Some material held by publishers is not scanned, so it cannot be searched for - Some material held by publishers is not scanned, so it cannot be used for marketing - There is no exception to allow libraries to scan materials without seeking permission from the copyright holders -
		Action	clarify the law. - Performed By: Legislators
		Consequences	All material held by publishers is scanned, so it can be searched for - All material held by publishers is scanned, so it can be used for marketing - There is an exception to allow libraries to scan materials without seeking permission from the copyright holders -
		Values	Research, learning, and teaching - Publisher profits - Legal clarity -

Figure 24 Consultation Instantiation New Consultation

Practical Reasoning Scheme

Circumstances

- 1 - Some material held by publishers is not scanned, so it cannot be searched for
- 2 - Some material held by publishers is not scanned, so it cannot be used for marketing
- 3 - There is no exception to allow libraries to scan materials without seeking permission from the copyright holders

Action

clarify the law. - Performed by Agent : Legislators

Consquences

- 1 - All material held by publishers is scanned, so it can be searched for
- 2 - All material held by publishers is scanned, so it can be used for marketing
- 3 - There is an exception to allow libraries to scan materials without seeking permission from the copyright holders

Values

- 1 - Research, learning, and teaching
- 2 - Publisher profits
- 3 - Legal clarity

Credible Sources Schemes - Circumstances

- 1 - Source: LIBER - In Domain: online research
- Some material held by publishers is not scanned, so it cannot be searched for
- Some material held by publishers is not scanned, so it cannot be searched for
- 2 - Source: LIBER - In Domain: online research
- Some material held by publishers is not scanned, so it cannot be used for marketing
- Some material held by publishers is not scanned, so it cannot be used for marketing
- 3 - Source: LIBER - In Domain: online research
- There is no exception to allow libraries to scan materials without seeking permission from the copyright holders
- There is no exception to allow libraries to scan materials without seeking permission from the copyright holders

Credible Sources Schemes - Consequences

- 1 - Source: LIBER - In Domain: online research
- Source Proposition: All material held by publishers is scanned, so it can be searched for
- Domain Proposition: All material held by publishers is scanned, so it can be searched for
- 2 - Source: LIBER - In Domain: online research
- Source Proposition: All material held by publishers is scanned, so it can be used for marketing
- Domain Proposition: All material held by publishers is scanned, so it can be used for marketing
- 3 - Source: LIBER - In Domain: online research
- Source Proposition: There is an exception to allow libraries to scan materials without seeking permission from the copyright holders
- Domain Proposition: There is an exception to allow libraries to scan materials without seeking permission from the copyright holders

Value Credible Sources Schemes

- 1 - Source: LIBER - In Domain: online research
- Asserts that action: clarify the law.
- affects value: Research, learning, and teaching - demote
- 2 - Source: LIBER - In Domain: online research
- Asserts that action: clarify the law.
- affects value: Publisher profits - neutral
- 3 - Source: LIBER - In Domain: online research
- Asserts that action: clarify the law.
- affects value: Legal clarity - promote

Value Recognition Schemes

- 1 - Source: LIBER - Value: Research, learning, and teaching
- 2 - Source: LIBER - Value: Publisher profits
- 3 - Source: LIBER - Value: Legal clarity

Consultation Information

- Consultation LIBER

Figure 25 Consultation Instantiation Consultation Summary

Appendix E: Data Dictionary

Here we give only the entities: the attributes of the entities have not been included in this document. These entries form part of the internal project documentation.

Data Dictionary Tables

The Data Dictionary contains the unified entities for the Structured Consultation Tool and the Critique Tool, although only the former are relevant to the deliverable (indicated with NR-SCT).

Entity Name	Description	Occurrence
action	The action used by the Practical Reasoning argumentation scheme.	One entry for every action.
action_agent	The agent-action pair used by the Practical Reasoning argumentation scheme.	One entry for every action-agent pair.
action_link	A link to the textual material.	One entry for every action.
agent	The agent used by the Practical Reasoning argumentation scheme.	One entry for every agent.
consult_value	Values used in the Credible Source scheme.	One entry for every instance of Credible Source about a value.
consultation	An id that ties together the schemes that are to be presented to the user.	One entry for every consultation.
consultation_inst	An instance of a consultation given by the consultation and a user.	One entry is created for each user who is consulted.
credible_source_as	The Credible Source scheme that represents that a literal (value) holds relative to a source, domain, and literal (value).	A pool of instances of the Credible Source scheme.
credible_source_conjunction	A conjunction for Credible Source AS. There may be more than one instantiation of the AS in a consultation	A pool of instances.
credible_source_occurrence	Conjunctions of the Credible Source AS.	A pool of conjunctions of Credible Source

		instantiations.
credible_source_ur	A user's response to domain source, domain literal (value), and domain of the Credible Source scheme.	For each user, there is an entry for the user's response to the various components of the instance of Credible Source scheme that is presented to the user.
domain	Domains are used in the Credible Source scheme in relation to literals and sources.	A pool of domains.
domain_proposition	The domain of the literal in the Credible Source scheme.	Each instance of a Credible Source scheme has a literal
domain_source	The domain of the source in the Credible Source scheme	Each instance of a Credible Source scheme has a domain source.
external_info	Auxiliary information about the consultation.	Each consultation instantiation has auxiliary information.
joint_action	Actions that are executed jointly. NR-SCT.	A pool of joint actions.
joint_action_agent	Joint actions associated with agents. NR-SCT.	A pool of joint actions and their agents.
literal	Each proposition is associated with two literals, postive and negative.	A pool of literals.
literal_conjunction	A conjunction for literals.	A pool of conjunctions. for literals.
literal_link	Associates a literal to source text. Used by the ART.	A pool of literal links.
practical_reasoning_as	The Practical Reasoning scheme that represents what an agent should do given circumstances, consequences, actions, and values.	A pool of instances of the Practical Reasoning scheme.
prop_occurrence	Indicates what literals are conjoined.	A pool of literal occurrences as needed for the Practical Reasoning scheme.

proposition_prur	A user's response to each literal of the circumstances and consequences of the Practical Reasoning scheme.	A pool of responses.
source	The source of some information.	A pool of sources.
source_proposition	Associates a source with a literal.	A pool of sources with literals.
state	A state as found in the Semantic Model. NR-SCT.	A pool of states.
state_literal	Associates a state with the literals that specify the state. NR-SCT.	A pool of states with their associated literals.
transition	Associates states, indicating the transition from one state to another state, as specified in the Semantic Model. NR-SCT.	A pool of transitions.
transition_value_link	Associates transitions with values, as specified in the Semantic Model. NR-SCT.	A pool of associations of transitions with values.
user	Users of the consultation.	A pool of users.
value	Values that are used in the Practical Reasoning scheme.	A pool of values. Each instance of a Practical Reasoning scheme is associated with values that are promoted or demoted by the argument.
value_conjunction	Conjunction for values as a consultation may use more than one value.	A pool of conjunctions for values.
value_occurrence	Conjunctions of values.	A pool of conjoined values.
value_prur	A user's response to each of the values of an instantiation of the Practical Reasoning scheme.	A pool of responses.

| value_recognition_as	An argumentation scheme that associates a value and the source that recognises that value.	A pool of instantiations of the scheme.
value_recognition_conjunction	A conjunction for the value recognition scheme as a consultation may have more than one instantiation.	A pool of conjunctions.
value_recognition_occurrence	Conjoined instantiations of the value recognition scheme.	A pool of conjoined instantiated value recognition schemes.
value_vrur	A user's responses to the value recognition scheme.	A pool of a users responses to the value recognition scheme.

Appendix F: Entity-Relation Diagrams
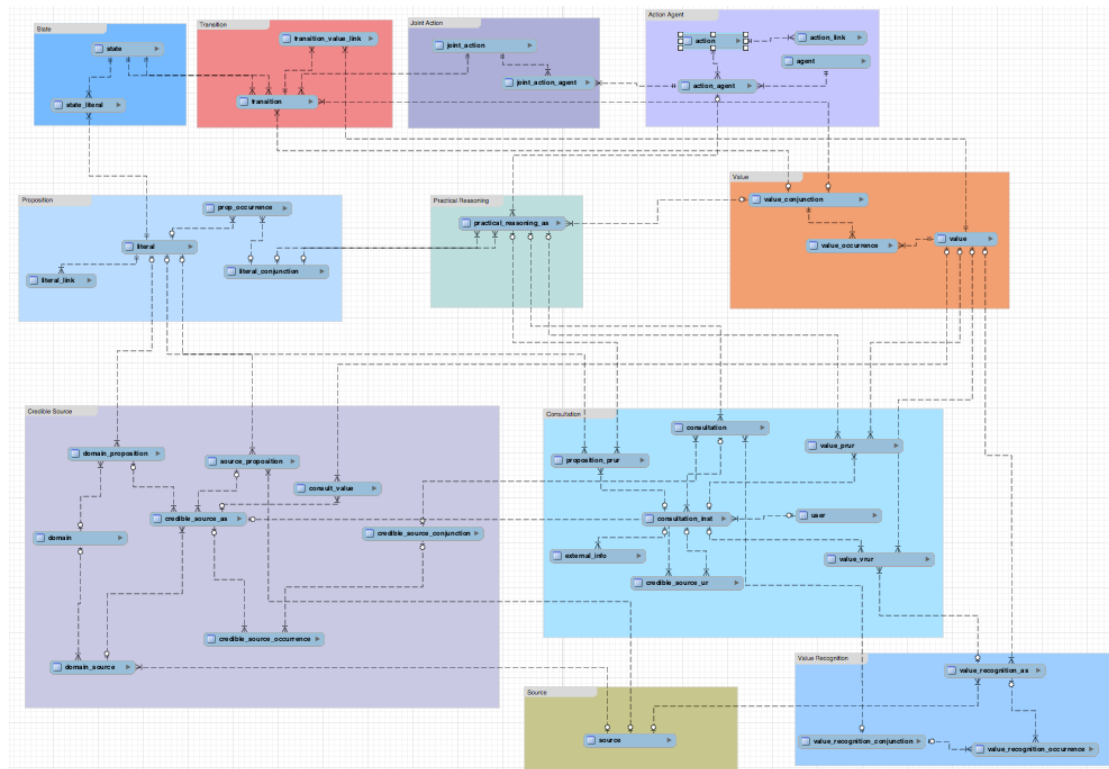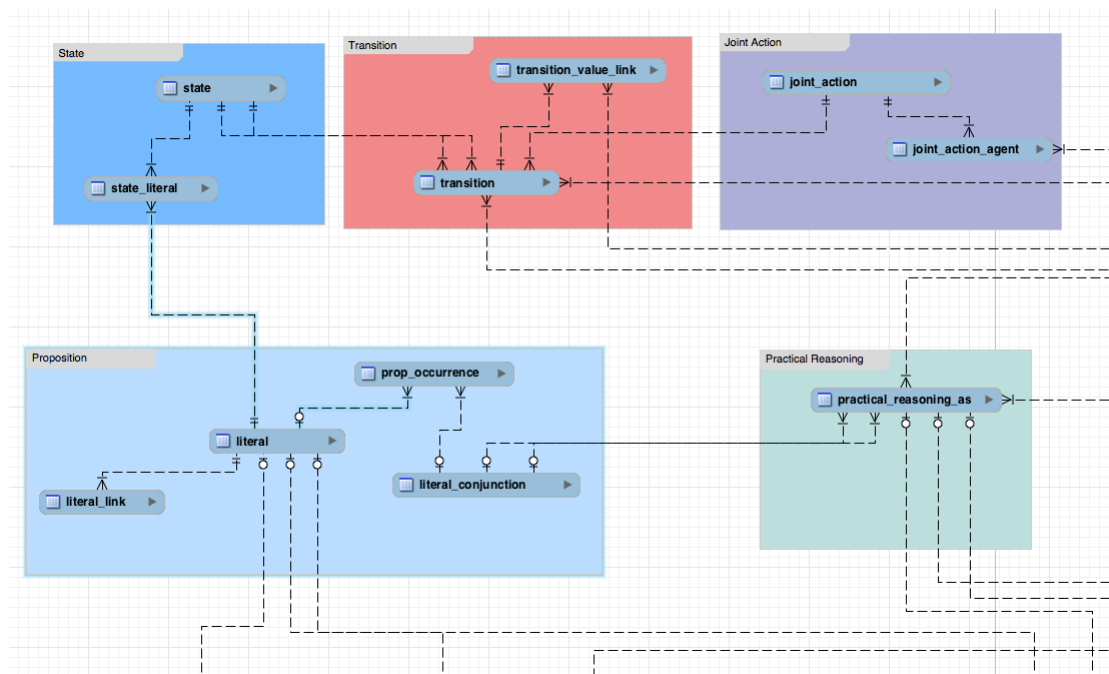

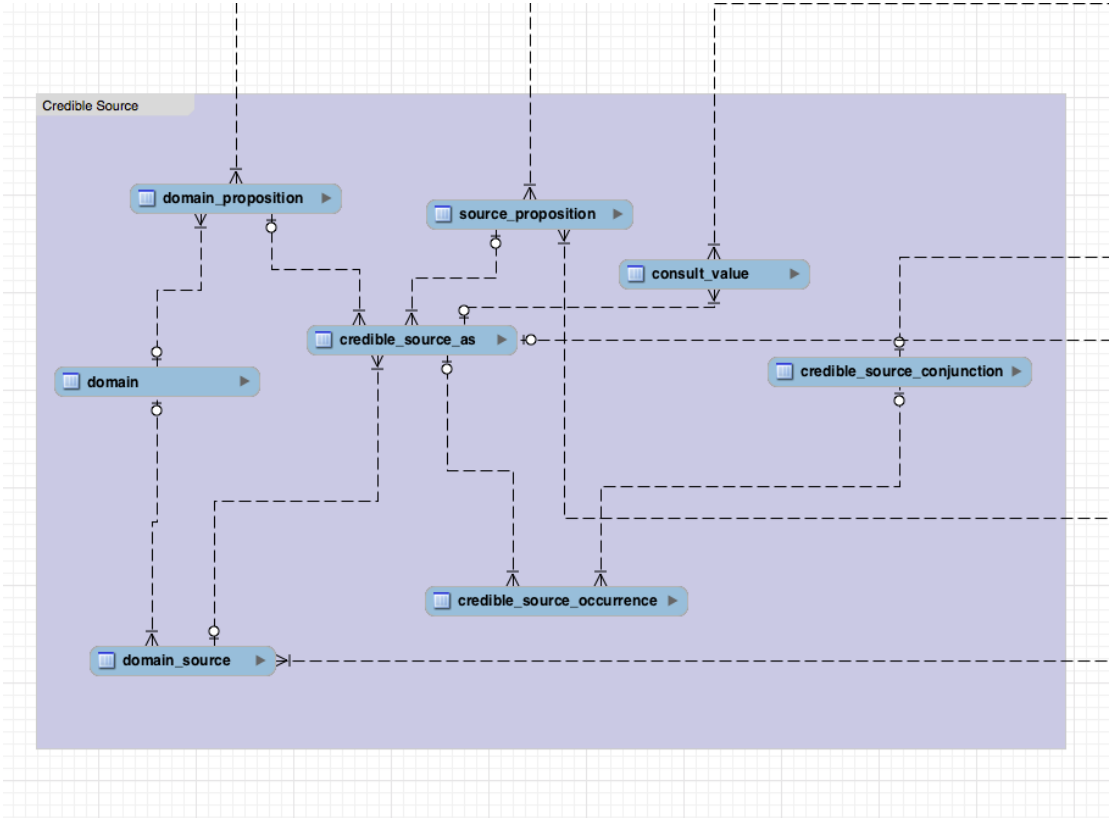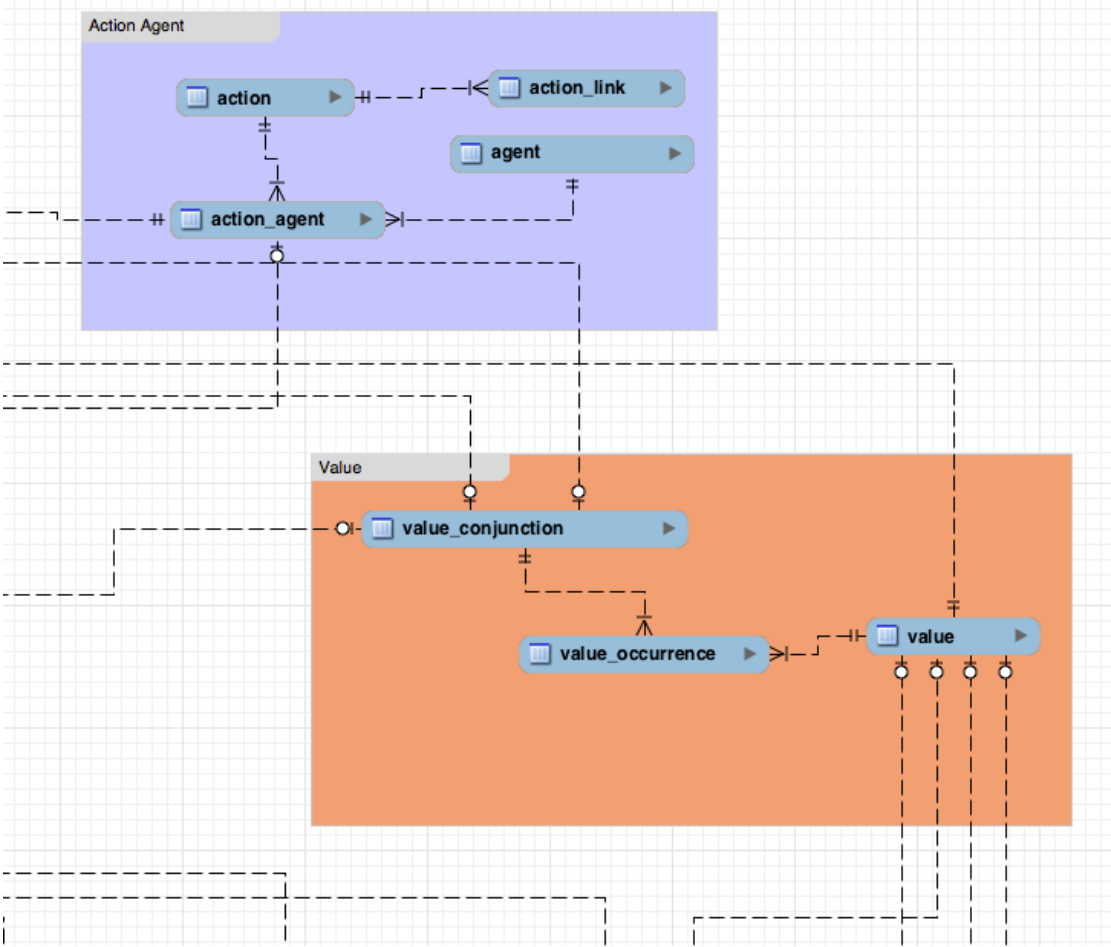*Figure 26 Whole Entity-Relation Diagram*

Figure 27 Section 1

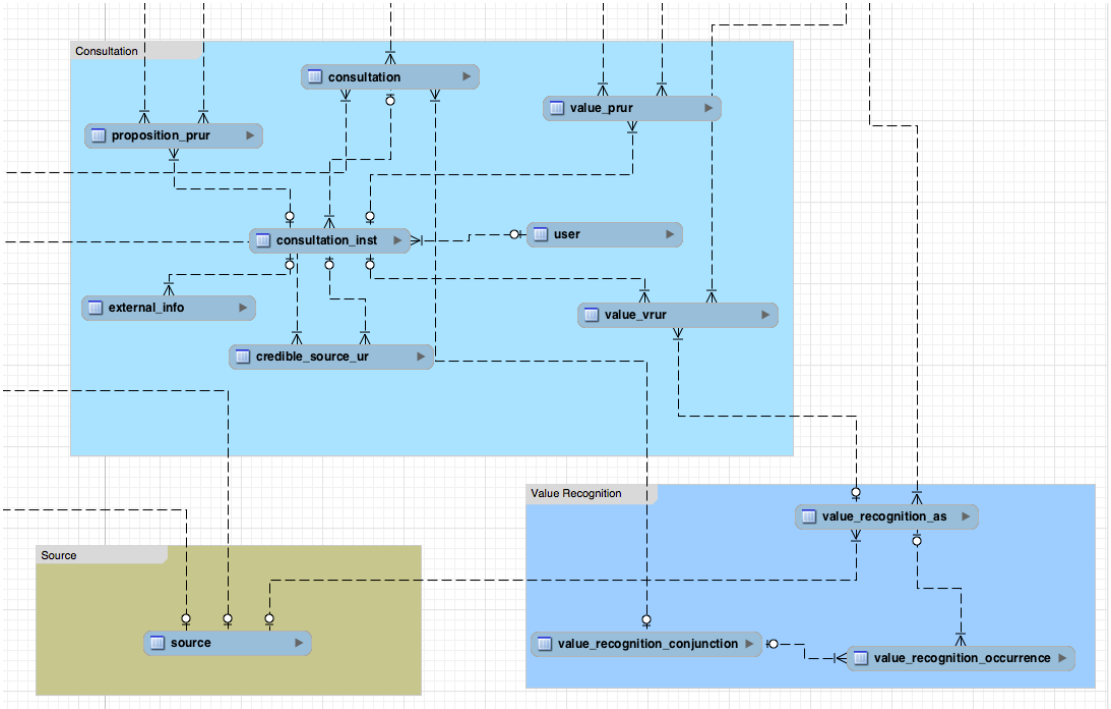*Figure 28 Section 2*

Figure 29 Section 3

Figure 30 Section 4