The Role of Artificial Intelligence in Online Dispute Resolution

by

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Abstract

In all ODR-procedures, Information Technology (IT) is used. Artificial Intelligence (AI) applications are a subset of IT applications and add benefit either by using 'intelligent techniques' or by 'simply' performing in an intelligent way. In this paper the (possible) use of AI in ODR is addressed. Two negotiation systems, SmartSettle and Family_Winner, are described and compared. An argument support tool for arbitration is also described, and it is argued that this tool could also be used in negotiation systems. A discussion of automated translation, automated summarizing, computer-mediated legal argument, and intelligent agents completes this paper on what AI can do for ODR.

1. Introduction

Research these days often starts with a Google-search on the topic studied. In our case, the first ten hits of the query:[1]

+"Artificial Intelligence" +"Online Dispute Resolution"

all referred to either the ODR workshop held in Edinburgh on June 28, 2003,[2] or our presentation at the UNECE forum on June 30, 2003[3] that this paper builds on. Since we were both involved in these meetings, and moreover addressed the topic AI and ODR in our Geneva presentations, we drew the tentative conclusion that we are *the* experts on this topic.

The search algorithms of Google are highly praised by almost all users of the Internet. The development of these algorithms is one of the subjects studied in the field of Artificial Intelligence, in a sub-field that is called Information Retrieval. The key terms in this field, recall and precision, express the effectiveness of the search system that is used (Kent *et al.* 1955). The term 'recall' refers to how many of the existing relevant documents are actually retrieved, and the term 'precision' refers to how many of the retrieved documents are actually relevant. In the first ten hits of the above query the precision was 100% (all documents were relevant), but the recall is harder to establish, since we don't know how many relevant documents actually exist on the Internet.[4] The human factor in selecting the actual terms used for the search is also a problem. This is illustrated with a second query using the following terms:[5]

+"Artificial Intelligence" +ODR

The results of this second query no longer support our initial conclusion that we were *the* experts on the subject of AI & ODR. The very first hit referred to a paper titled 'Artificial Intelligence in Alternative Dispute Resolution' contributed by the Italians, G. Peruginelli & G. Chiti, to the *Workshop on the law of electronic agents* (LEA 2002) held in Bologna in the summer of 2002. The Italians use the term *On line* Dispute Resolution, while we used the term *Online* Dispute Resolution in our first query. What a difference one space can make! While browsing through the list of contributions to the LEA workshop[6] we also found another paper relevant for our topic: Gouimenou (2002). He did not use our search terms in

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1 On 28 July 2003.

2 <www.odrworkshop.org> viewed 2003 Aug 13

3 <www.unece.org> viewed 2003 Aug 13

4 When IR-systems are tested normally a standard document base is used for which it is possible to indicate the number of documents relevant for a particular query.

5 On 28 July 2003.

6 <http://www.cirfid.unibo.it/~lea-02/online.html>

his paper (expect the term ODR in a figure that the search engine could not recognize), but his paper was about e-arbitration and the use of intelligent agents. The latter is another sub-field of AI that we will briefly address later. These examples make several points clear. First, AI systems can be very helpful, but they depend on the input of both the designer, in our example the search system, and the user. The first paper by the Italians would have been found immediately if either the user had entered synonyms, or the designer had implemented a thesaurus or an algorithm that also uses small variations of the search terms (e.g., for Online also trying On line and On-line). Second, what is obvious for humans is not necessarily so for computers. Domain knowledge is needed to know that e-arbitration is a sub-field of ODR, and that the use of intelligent agents is a sub-field of AI. For both the designer and the user, the second 'miss' is a harder nut to crack than the first one. In general, artificial intelligence might help in realizing better performance, but no computer application is perfect. This paper highlights (possible) use of AI in ODR.

The remainder of this paper is structured as follows. In the following section, general observations on AI and the sub-field AI & Law are made. Next, in Section 3, two negotiation systems, SmartSettle and Family_Winner, are introduced and compared. In Section 4 an argumentation support tool is described and it is argued how it could be used as an additional feature to negotiation systems. In the last section other research relevant for ODR is discussed, respectively: automated translation, automated summarizing, computer-mediated legal argument, and intelligent agents.

2. Artificial Intelligence and AI & Law

2.1 Definition and the Turing Test

Artificial Intelligence is sometimes defined as

> "…trying to solve by computer any problem that a human can solve faster." [7]

The above meaning seems to be ambiguous, perhaps intentionally, for it is not clear who is faster, the human or the computer, although it seems to refer to problems that a human can solve faster. With a slight modification, the definition becomes:

> "…trying to solve by computer any problem, that a human can solve, faster."

Whilst the first definition represents a skeptical view on AI, the second is more optimistic. This second definition can also be extended to:

> "…trying to solve by computer any problem, that a human can solve, better, faster, more consistently, without getting tired, etc."

This definition reflects closely the idea people (mostly outside the field) have about AI, that is often associated with computers acting like humans and doing all kind of amazing things, such as in popular movies like Andy and Larry Wachowski's The Matrix (1999) and Steven Spielberg's *A.I.: Artificial Intelligence* (2001).

In 1950, Alan Turing, one of the founding fathers of AI, claimed:

> "I believe that at the end of the century ... one will be able to speak of machines thinking without expecting to be contradicted."

Turing is famous for the test named after him, viz. The Turing test. It basically comes down to the following: a person communicates without knowing whether s/he is talking to a human or a computer. If, during a certain limited time period (e.g., 15 minutes), s/he decides that s/he is probably talking to a human, the program has passed the test and can be qualified as 'intelligent'. This test is of course not foolproof. If, for example, a chess player believes

[7] The Free On-line Dictionary of Computing, © 1993-2003 Denis Howe.

that he is playing against a computer that is better than he is (and this is in fact the case), the program would not pass the test. If we modify the test a little to depend on the subject's belief about computers, i.e., that they can actually appear to be even more intelligent than a human in some situations, then the test still holds.

2.2 AI & Law

Although some results in AI are beyond what was expected about 25 years ago, for example the victory of the program Deep Blue over the chess world champion Kasparov, in most sub-fields progress has not been made as quickly as initially thought.

In one of these sub-fields, AI & Law, the application of computer technology to the field of law is studied. In particular, people from outside this field expect that the main objective is to design computers that can take over the role of the judge, that is, so-called expert systems or knowledge (based) systems. These systems would not only decide cases, but also provide justification for their decisions based on the rules used to arrive at a particular conclusion. A simple example helps to illustrate how these systems work. In some areas, in particular in administrative law, knowledge systems have been developed on the basis of that the input of relevant facts enabling a decision as to whether or not, for example, an unemployment benefit should be granted. The decision is not communicated straightforwardly to the applicant but first checked by the employee using the computer. This is the reason why these systems are called decision *support* systems. In the Netherlands such a system, the so-called BOS, is even used by the Prosecuting Authority to determine the severity of the punishment in cases with a maximum penalty of up to four years imprisonment.[8]

In the field of ODR, blind-bidding systems are sometimes called expert systems (Van den Heuvel 2000, p. 8):

> "Online settlement, using an expert system to automatically settle financial claims"

Although blind-bidding systems actually yield case decision and are therefore sometimes headed under automated arbitration (Rule 2002, p. 57-58), they cannot justify their decision. More importantly, they do not arrive at conclusions on the basis of reasoning with rules (as expert systems do), but merely apply a simple algorithm to determine whether offer and counter-offer are within a certain pre-defined range. We therefore would not call the blind-bidding systems expert systems, and in general believe that today a possible role of expert systems in ODR is at best a modest one.

Apart from various, even commercially successful, systems operating on small, straight forward domains, it appeared that developing legal expert systems was more complicated than it seemed at the beginning of the 1980s. In an attempt to solve complex issues such as how legal reasoning and argumentation could best be represented in a computer, in the 1990s fundamentally oriented research has been carried out. This research led to systems of non-monotonic logic, argumentation theories, and dialogical models of legal reasoning. In general, the developed logical tools for the modeling of legal argument can deal with, but are not limited to, undercutting and rebutting arguments, weighing of principles, reasoning about rules, lines of argumentation, and commitment and burden of proof.[9] Although interesting from a theoretical point of view, the results cannot be translated easily to practical models of legal reasoning. Therefore, from 1995 onwards several people (Oskamp, Tragter & Groendijk, 1995) have argued that to obtain theoretically-founded, good working systems, it is important that the results of fundamental research are applied in a way that more people can understand than just logically oriented AI & Law people.

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[8] The, Dutch, program can be downloaded from <www.om.nl/bos>.

[9] For an overview of the results see Verheij, Hage & Lodder 1997, and Hage 2000.

The following sections describe three AI & Law systems that are interesting from an ODR perspective; two negotiation systems and an argument-based system. First we describe and compare the two negotiation systems and then describe an argument-based system suggesting that it could add useful functionality to a negotiation system.

3. Negotiation systems

This section first introduces Thiessen's SmartSettle system and Zeleznikow & Belucci's Family_Winner and then compares the two systems. Although the research behind Family_Winner (late 1990s) is from a later date than SmartSettle (early 1990s), Zeleznikow & Belucci were not aware of the existence of SmartSettle when designing Family_Winner. The explanation for this 'omission' is that the development of these systems has occurred within two independent disciplines. Family_Winner is developed from an AI (& Law) background while SmartSettle has its roots in engineering science. Therefore, SmartSettle is not an AI system in the traditional sense that particular AI techniques are used or that it builds on prior AI systems. However, if we keep in mind our definition of AI, it is clear that SmartSettle must also be considered an AI system. This will become even more evident from the descriptions that follow, which show striking similarities. The similarities may be due in part to having been influenced by early pioneers in the political science field such as Raiffa (1982), Fisher (1983), and Ury (1991).

3.1 SmartSettle

SmartSettle[10] is a sophisticated negotiation system that can support any number of decision makers with conflicting objectives to resolve problems with virtually any level of complexity. With the aid of a qualified facilitator for untrained users, SmartSettle elicits preferences on the outcomes of any number of negotiation variables.[11] SmartSettle models outcome preferences with mathematical formulas and then uses optimization with standard mixed-integer programming techniques to generate solutions that are both fair and optimal according to the preferences of the parties. The optimization routines used are either linear or non-linear, depending on the complexity of the problem. The underlying algorithms used by SmartSettle are based on the ICANS algorithms described by Thiessen & Loucks (1992), Thiessen (1993) and Thiessen, Loucks & Stedinger (1993), who prove the validity of the methodology.

Preferences for each party are represented with satisfaction functions for negotiation variables identified by the parties. These variables may be shared decision variables (issues) or private variables that are related to shared variables by means of private constraints defined by each party. The importance of particular outcomes to each party for the various variables is defined with reference to private bargaining ranges. Users may define satisfaction functions with their own mathematical formulas, draw them graphically, or use some combination that best represents their preferences. SmartSettle also provides a non-quantitative method called "even swaps" that enables a decision maker to intuitively fine-tune the tradeoffs that have been implicitly defined by satisfaction functions. All aspects of a user's preferences may be modified at any time during the process of negotiations. This is appreciated by negotiators who know from experience that preferences may change significantly during the course of negotiations.

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[10] The SmartSettle negotiation system is research and development product owned by ICAN Systems Inc. It is promoted and commercially available at www.smartsettle.com.

[11] Future versions of SmartSettle will also elicit preferences on methods of communication. SmartSettle's mode of communication will then automatically adjust according to each user's preferences changing language and vocabulary options, visual and sound effects and even kinesthetic options, thus increasing the effectiveness of communication between negotiators (Madonik, 2001).

A key component of the SmartSettle system is a neutral site that manages confidential preferences and combines them into a composite model that simultaneously represents the outcome preferences of all parties. Users may access the SmartSettle neutral site from the same building or from opposites sides of the globe.

The SmartSettle process requires parties to initially collaborate in creating a Framework for Agreement (FFA). This part of the process may involve each party first identifying an optimistic outcome, in the context of a comprehensive proposal. Whoever is creating the first draft of the FFA will attempt to combine these proposals into a single text. This single text is similar to another instrument known as a Single Negotiation Text (SNT) developed by Fisher and Ury (1981).[12] Both instruments are similar in form to a final agreement. The SNT is a draft with actual values to be improved upon by the parties whereas the FFA is essentially a generic form containing blanks representing unresolved issues. Creating a good FFA is as much or more art as it is science. Training, practice and good communication skills are all necessary ingredients. Negotiators that are separated by such great distances that physically meeting is impractical have additional communication challenges to overcome. It is important (Madonik, 2001) that they communicate efficiently to conserve the energy required to reap the rewards that other negotiators without sophisticated tools simply leave behind on the table.

The next task is for the parties to specify their basic private preferences in terms of the bargaining ranges established by initial informal proposals and the process of creating the FFA. This allows them to use the SmartSettle graphical interface for exchanging proposals and begin working towards a tentative solution.

SmartSettle has various methods that negotiators may use to reach a tentative solution. One way is to negotiate in a conventional manner by exchanging proposals, each of which is a complete package representing decisions to be made on all defined variables. Users may also have SmartSettle generate Suggestions, which is a form of multivariate blind bidding. Another method of negotiating with SmartSettle is with Reflections. Reflections allow negotiators to exchange proposals that are represented by single numbers defined in terms of another party's preferences. Compared to reaching a solution on their own, users tend to achieve outcomes that are closer to the efficiency frontier if they agree to accept a package generated by SmartSettle. If parties reach an impasse, they can ask SmartSettle to attempt to solve it for them by generating an Equivalent package, which is one that gives each negotiator at least as much satisfaction as they have indicated that they require.

In the final phase, SmartSettle allocates remaining "value on the table" fairly to all parties according to an algorithm called "maximize the minimum gain". By this time in the process, preferences should be well represented. If so, then the final phase is relatively short, and could simply involve a single request for improvements. It may happen that SmartSettle can find additional gains to divide among the parties by exploring beyond soft constraints; bargaining ranges that may have been inadvertently defined too narrowly by the parties. When parties are satisfied that no more improvements can be found, they take the best solution found and fill in the Framework for Agreement to produce a final document for implementation.

3.2 Family_Winner

In Family_Winner (Bellucci and Zeleznikow 2001) both game theory and heuristics are used to provide negotiation support. Family_Winner supports the process of negotiation by introducing importance values to indicate the degree to which each party desires to be awarded the issue being considered. The system uses this information to form trade-off rules. The trade-off rules are used to allocate issues according to the logrolling strategy. The system makes this analysis by transforming user input into trade-off values, used directly on

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[12] See also <http://www.negotiation.hut.fi/theory/NegotiationAnalysisPage.htm> viewed 2003 July 29.

trade-off maps, which show the effect of an issue's allocation on all unallocated issues. The user is asked if the issues can be resolved in its current form. If so, the system then proceeds to allocate the issue as desired by the parties. Otherwise, the user is asked to decompose an issue chosen by the system as the least contentious. This process of decomposition continues through the one issue, until the users decide the current level is the lowest decomposition possible. At this point, the system calculates which issue to allocate to which party, then removes this issue from the parties respective trade-off maps, and makes appropriate numerical adjustments to remaining issues linked to the issue just allocated.

The starting point for the mediation is to form a set of issues in dispute. This set D is a union of the sets entered by each of the parties, in case of a divorce the set of issues that H(usband) sees as in dispute, and the set of issues that W(ife) sees as in dispute: $D = H \cup W$ where $H = \{H_1, H_2, \dots, H_n\}$ is and $W = \{W_1, W_2, \dots, W_m\}$. H and W are then asked to give a significance value to each of the issues in set of issues in dispute D. The sum of the significance values for both H and W is 100. We hence have two sets $H_D = \{H_{D1}, H_{D2}, \dots, H_{Dk}\}$ and $W_D = \{W_{D1}, W_{D2}, \dots, W_{Dk}\}$ where $\Sigma H_{Di} = \Sigma W_{Di}$. This information is necessary to initiate the negotiation.

The distribution algorithm works as follows. We first calculate $d_1 = \max \{| H_{Di} - W_{Di} |\}$. Let us say this value i1 occurs where $H_{Di1} >= W_{Di1}$ so that H receives the item to be distributed.

Then

$$H^* = HDi1 \text{ and } W^* = 0$$

Choose $d_2 = \max \{(W_{Di} - H_{Di}) : i \text{ not equal to } i1\}$, the issue (D_{i2}) goes to W and

$$H^* = H_{Di1} \text{ and } W^* = W_{Di2}$$

Now,

$$\text{IF } H^* >= W^*$$

then choose $d_3 = \max\{(W_{Di} - H_{Di}) : i \text{ not equal to } i1 \text{ or } i2\}$, the issue (D_{i3}) goes to W and

$$H^* = H_{Di1} \text{ and } W^* = W_{Di2} + W_{Di3}$$

ELSE

choose $d_3 = \max \{(H_{Di} - W_{Di}) : i \text{ not equal to } i1 \text{ or } i2\}$, the issue (D_{i3}) goes to H and

$$H^* = H_{Di1} + W_{Di3} \text{ and } W^* = W_{Di2}$$

This procedure is repeated recursively until the last issue is to be distributed is reached. This last issue goes to the party that has been rewarded the least. The algorithm is an adaptation of the AdjustedWinner algorithm of (Brams and Taylor 1996) who prove the validity of the algorithm.

3.3 SmartSettle and Family_Winner: a comparison

In this section we make some general observations regarding the commonalties and differences between SmartSettle and Family_Winner. Our objective here is not to do a comprehensive review that would conclude that one system was better than the other. Which system particular users might choose depends on various factors such as the type and complexity of conflict to be solved, number of parties involved, etc. In a forthcoming work, a more rigorous comparison will be done showing the results of hypothetical cases solved with each system.

The support offered in SmartSettle is very sophisticated and even includes suggestions for improvement over a tentative agreement (beyond win-win). Unless a person has had training in optimization techniques, it may not be easy to understand in detail how the algorithms of SmartSettle work. However, with a little explanation, most people don't have too much trouble with the general algorithm, "maximize the minimum gain". In fact, Raiffa

(1996), a respected pioneer in the field of decision analysis, claims that the algorithm used by SmartSettle is even easier to explain than the one developed by Nash (1950), i.e., “maximize the utility product”. Nevertheless, SmartSettle makes no attempt to get users to understand how it works. SmartSettle is designed on the premise that, while many people may be interested in how a system gets them to where they want to go, they are usually far more interested in the end result (i.e., the proof is in the pudding). In this respect, it is more like a black box depending on producing a good result that users will be satisfied with.

In general, the more sophisticated the support, the more difficult a system is to use. This rule of thumb holds true when comparing SmartSettle with Family_Winner. Depending on the training and experience of the parties, the SmartSettle system cannot usually be used to its full potential by novices without the assistance of a facilitator. Being relatively simple in comparison to SmartSettle, Family_Winner’s allocation algorithm is not hard to understand and negotiators can use the system with little or no training.

Both systems offer their users advanced support for any number of issues. Parties start by identifying issues, from which are derived a set of decision variables to be negotiated. One difference is that SmartSettle is a multi-party system, while Family_Winner is designed for two-party disputes. Both systems use numerical algorithms to determine relative importance for each issue. SmartSettle is a type of blind-bidding system that generates a number of different kinds of packages (representing bundles of variables), whereas Family_Winner uses a method that solves issues piecemeal, i.e., in sequence according to their importance.

Although SmartSettle was not originally designed to handle single issues, its multivariate blind bidding system simplified to a single issue is actually quite elegant and superior to other existing systems that use single-issue blind bidding algorithms. The SmartSettle developers are working on a simple mode interface that will make such applications more practical. Since the Family_Winner design is not able to handle single-issue problems directly, Family_Winner tries to remedy this by asking the parties to decompose single issues into sub-issues whenever possible.

One thing that is common between the two systems is the lack of support for solving issues on the basis of objective criteria. This is where we see a potential benefit in combining negotiation systems with argumentation systems, which, by the way, excel at solving problems with single issues. We discuss argumentation systems in the next section.

4. Argumentation: structuring the information exchange in Arbitration

4.1 Argument support tool based on dialogical model

The AI & Law model of legal justification DiaLaw (Lodder & Herczog 1995; Lodder 1999) is a dialogue game that is played by two players. A dialogue starts if a player introduces a statement s/he wants to justify. The dialogue ends if the opponent accepts the statement (justified) or if the statement is withdrawn (not justified). The rules of the game are rigid, the language used in the game is formal. The rigidness helps in presenting a clear picture of the relevant arguments. By using special language elements players can, under given circumstances, be forced to accept or withdraw statements. Due to its formal language DiaLaw is not an easy game to play. However, the ideas underlying DiaLaw, make it well-suited for supporting a natural language exchange.

In general, whether a system is convenient to use or not (Katsh & Rifkin 2001) depends largely on a particular user’s preferences (Madonik 2001). People with a logical background might prefer a very rigid system over a system that can deal with the richness of natural language. Due to different backgrounds, communication problems often occur in the area of software development in the legal field: the talk of IT people and legal people passed right by each other. The former do not get a grip on the broadly, vaguely speaking lawyer, while the former cannot follow the brief, schematic wording of the IT people.[13] The possibility of offering different communication modes to each user depending on their preferences might help in overcoming this problem.

4.2 Definition of the online arbitration tool

Lodder & Huygen (2001) presented an argumentation support tool based on the ideas of DiaLaw. Currently, the implementation is almost completed.[14] By structuring the entered information, the tool aims to support parties engaged in an arbitration procedure regarding domain names. Lodder & Huygen (2001) claimed that although the tool was primarily made to support arbitration, it could be used for other types of ODR, like negotiation and mediation, as well. This claim was substantiated again by Lodder (2002).

The argument tool works as follows. Statements are natural language sentences. A party using the argument tool can enter one the following three types of statements.

1. Issue – A statement that initiates a discussion. At the moment of introduction this statement is not connected to any other statement.
2. Supporting statement – Each statement entered by a party that supports statements of the same party.
3. Responding statement - Each statement entered by a party that responds to statements of the other party.

A statement that is entered by the parties is represented as follows: P(E, Q(C)), where P is the party who adds the statement, E is the entered statement, C is the statement E is connected to, and Q is the player who claimed C. If a statement is an issue we have P(E, P(E)). From the definition of the other statements above follows that:

- P(E,Q(C)) is a supporting statement iff $P = Q$;
- P(E,Q(C)) is a responding statement iff $P \neq Q$.

After a party entered a statement, an element P(E, Q(C)) is added to a set called the games board G. Because an issue is the only statement not connected to other statements at the moment of introduction, it is clear that the first statement added to the games board is always an issue. In case of arbitration the first party claims issues and provides support, and when he is finished he hands over the games board to the other party. This party can on his turn add any of the three statement types defined above.

The domain name procedure is special, because even prior to the proceeding it is clear what the issues are about (confusingly similar, illegitimacy, and bad faith). The present tool is not meant as a stand-alone application, but could be incorporated in an existing domain name procedure such as WIPO offers. We believe that both the parties and the panelist(s) would benefit if the tool is used to structure the information entered by the parties. In order to show how, we give as an example the DavidGilmour.com case of December 15, 2000. The complainant in the dispute is David Gilmour, (former) member of Pink Floyd, and the respondent is Mr. Cenicolla of Logic Minds, who owns the domain name davidgilmour.com.[15]

The complainant adduced basically the following information to support the 'Identity' issue: The name David Gilmour represents the goodwill in the musical works and other projects with which he has been involved since the 1970s. Although the name is not registered as

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[13] The Dutch dissertation of Zouridis 2000 provides several examples.

[14] See <http://www.cli.vu/~huygen/odr/odr.html>.

[15] <http://www.arbiter.wipo.int/domains/decisions/html/d2000-1459.html>.

trademark, two companies bear his name. Moreover, the registered domain name is identical to the artist's name. In support of the 'Illegitimacy' issue, it was adduced that the respondent has no involvement with Gilmour or his company and that there is no evidence that respondent is known under the domain name. Finally, the 'Bad faith' issue was supported by the following: The domain name has been registered by an organization that has a number of other domain names of celebrities registered. The domain name davidgilmour.com is only used as link to the Logicminds home page, which is a site that offers domain names for sale. On this Logicminds site there is advertisement for the sale of the domain name davidgilmour.com.

The respondent, Mr. Cenicolla, claims to have registered the domain name davidgilmour.com to communicate with fans of David Gilmour (but he has not used it for that purpose yet). He also claims to have the intention to obtain a license for Gilmour merchandise (but he actually has not asked one yet) and he states that including any Gilmour merchandise on davidgilmour.com would promote Gilmour's work. Finally, he asserts that the domain name davidgilmour.com was only offered for sale by mistake and has been removed from the 'for sale'-list.

4.3 The user interface

The screen dump is of a prototype, which is a proof of concept implementation.

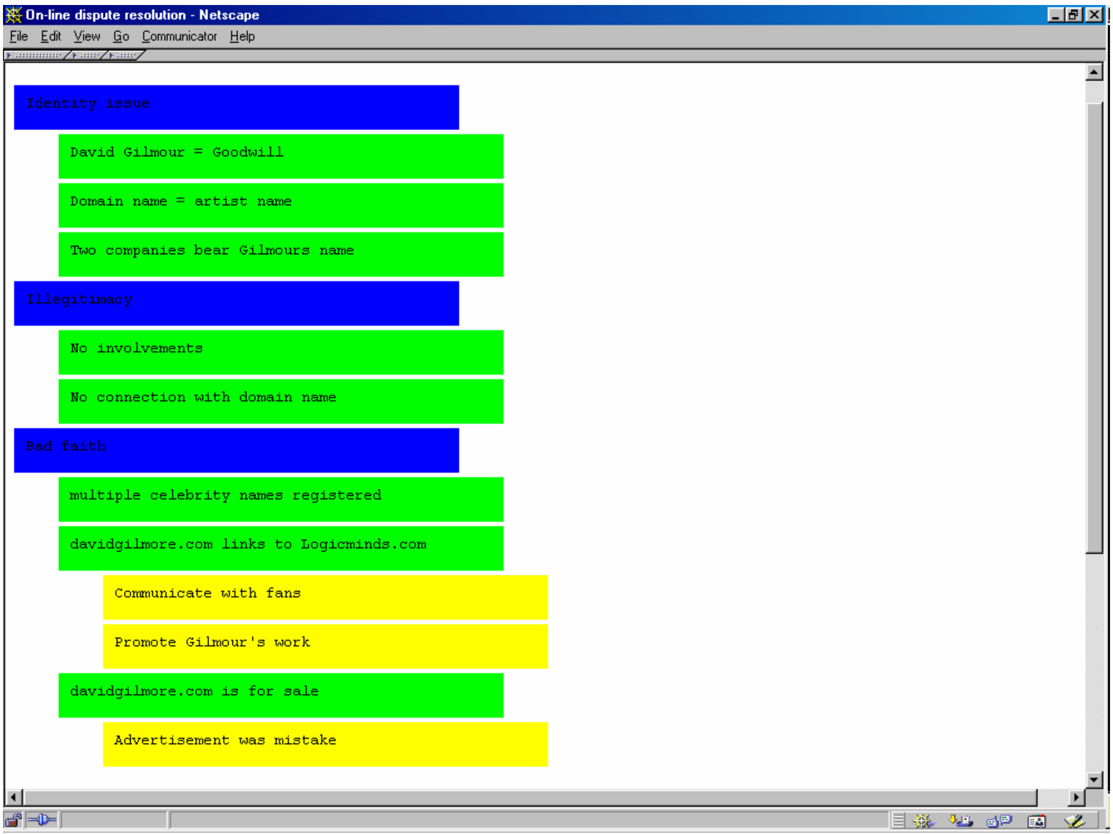

Figure 1 The ODR applet

It represents the Davidgilmour.com case discussed above. Each statement occupies a line and the indentation indicates the structure of the statements in the argument. The color indicates whether a statement is an issue, a supporting or an opposing statement. When the user clicks on a statement with the mouse, s/he can read the full text of the statement, and she can attach another statement to it, if s/he is entitled to do so.

Note that the above screen-shot is a reconstruction to show the working of the model. Because the program has not actually been applied by the parties during the process, the current analysis of the Gilmour case may be inaccurate on points. The first step of David Gilmour, the complainant, is to identify an issue. Normally, a complainant is free to assert any issue. Since in a domain case three particular issues have to be asserted, Gilmour starts with identifying the Identity issue. Subsequently, Gilmour has to adduce one or more statements supporting the issue (second step). In this case he asserts three supporting statements, shown in the indented fields under the Identity issue. In the same manner the Illegitimacy issue is identified and two supporting statements are adduced. The third and last issue, about Bad faith is accompanied by three supporting statements. There are no additional issues left, so by handing over the games' board in which the information is structured as in the first column, the complainant's turn ends.

The respondent, Mr. Cenicolla, can respond to all statements of his counterpart he does not agree with. In the current case neither the Identity and Illegitimacy issue, nor the statements supporting these issues are responded to. The respondent only reacts to the Bad faith issue. He adds two statements in reaction to the second supporting statement, and the third supporting statement of the Bad faith issue is responded to with one statement.

In the current case, the games board has not been handed over after the second turn, so the program stops here. Obviously, the ODR-providers can indicate how many times the games' board may be handed over and within what time constraints it must be handed over.

By structuring the Gilmour case, several things are clear at a glance. First, the respondent did not attack any of the statements with respect to the first two issues. So, for the first two issues the arbiter solely had to concentrate on the statements adduced by the complainant. Regarding the third issue the arbiter also has to take into account the statements of the respondent. Even in a relatively simple case as this one, the arbiter would have benefited from a dispute structured as indicated above. In more complex cases, information structured in the above way would turn out to be even more profitable. In general, the arbiter now has not have to go through plain text files of the claimant and the respondent, but in stead can use one structured document to prepare his decision.

5. Argumentation support in negotiations

The tool presented here is meant for arbitration, but could also be used in negotiation or mediation. In that case the tool is no longer a 'game' in which parties take turns. Rather, parties must be able to add statements at any given moment, and even simultaneously. We believe that for negotiation/mediation, this is a more natural way of exchanging information, especially in an online environment. If the tool is used in this way, it might be considered to be used as an additional feature of SmartSettle or Family_Winner.

A fundamental difference between a negotiation system and models of argumentation is that the latter are primarily focused on obtaining your position, while the aim of the former is "not obtaining your position but satisfying your interests." (Ury 1991, p. 18)

Positions are related to potential outcomes of the issues in dispute. Unless parties share positions on all of the issues, they have no agreement. Positions might change during negotiations (e.g., due to bargaining); interests are less likely to change. The following family law example illustrates the difference between positions and interests. Assume that Mary and Barry have been married for 10 years and decide to get a divorce. They own a $ 300,000 house, and a car worth $ 50,000. Suppose that Mary asks for the car and half the house. Barry says that is ok as long as she pays the mortgage and lets him live in it until it's paid. These statements represent positions. They articulate little about the underlying interests, which depend on their respective financial situations and how much they value the items they are negotiating about.

At first blush, it might seem that an interest is not worth arguing about but a position is. An interest is usually self-evident once articulated and seems to be an argument in itself. However, a single party can have different, sometimes even contradicting interests. In that case, support for these interests might help in getting the dispute solved. For example, an employee may want to earn as much money as possible on the one hand, and still work as few hours as possible on the other hand. Undeniably, in cases of such contradicting interests, satisfaction of one interest will lead to dissatisfaction of the other. Typically, for example, justifying interests will not help the negotiations between the aforementioned employee and his employer when discussing the salary and working hours. Adducing support for a position may not help either. For example, in what way could the employee support his position of wanting to work three days a week and get paid $5000 a month help to reach agreement? Nonetheless, the employee may provide an explanation, or the employer might ask for one. Providing a justification or giving an explanation, means supporting a position or an interest.

The argument support tool can be used to register the support of a position or interest. In the above example, the employee might have to spend time at home due to family circumstances and need the money for the same reason. This information might support both his interests and his positions. This example illustrates how, during this negotiation, parties could air positions or interests using the argument support tool. As a consequence, the employer could be willing to meet the demands of the employee, for example, as long as the family circumstances remained the same. The crux of the above example shows that argument tools might be helpful in negotiations. In general, an explanation or justification can make another other party understand particularly why the counterpart is making a particular point. What is important is that the tool is used in spirit of the general philosophy of ADR: cooperation. Accordingly, the tool must not be used to simply throw in one's positions provided with support, and, in case the other party reacts to the positions or the supporting statements, just add more support and attack the reaction of the opponent. It is important that parties try to listen to one another and try to understand each other. Using *only* an argument support tool may lead to two fighting parties, each just arguing for its own position.

Successful negotiations with an argument support tool depend on parties approaching the task with the right attitude, i.e. attacking the problem rather than each other. It is also preferable that the argument support tool be used in combination with other ADR methods, so that the argument support tool is merely an optional among various means of communication available. The support tool could for example be provided as a formal option within the SmartSettle software, which currently has a Meeting Place, which is a more informal forum for communication.

As noted at the beginning of this section, taking a position is not what negotiation should be about. It appears, however, that arguments put forward to justify positions or interests might help to solve the dispute. Showing the reasons for your position does not necessarily leads to adversarial discussions. Rather, providing explanation or justification can lead to understanding, so instead satisfies the co-operative goal of ADR. One has to bear in mind though that if an argument support tool is used, it has to be used cautiously and not to just support one's position in order to obtain whatever is desired.

A problem with using an argument support tool in negotiations is that not under all circumstances providing support is significant. Support can be trivial. For example, if one party in a divorce case wants to retain a painting done by his grandmother and parties know how important this painting is to him/her, providing support would not have any value. Also, support might reveal too much about bargaining position. Therefore the argument support tool must be used with discretion rather than be obligatory.

A purpose for which the argument support tool could be used is to identify at each moment during negotiations the issues to which the parties agree. Cases of numerical issues of disagreement on the amount do not necessarily mean disagreement about the issue itself. For instance, if a party is willing to compensate $100 and the other party wants $150 then there is consensus regarding the compensation.

Another point that needs to be noticed is that multiple issues cannot always be solved one-by-one (piecemeal). For that reason the argument support tool may seem to be less useful, because support is provided for just one issue at the time. However, the explanation or support can take the interrelation between issues into account. This type of support may be useful for solving the dispute, but the party providing this type of support has to be careful not to give away information that weakens his/her position in the negotiation.

6. Miscellany

In addition to the above discussed negotiation systems and argument tool, in this section we briefly discuss four other areas of AI that are interesting for ODR: automated translation, automated summarizing, computer-mediated legal argument, and intelligent agents.

6.1 Automated translation

Altavista's Babelfish[16] is a translation tool which is far from perfect, but nonetheless can help in understanding (the main) parts of a communication in a language that one does not speak. Natural language processing, in particular automated translation (Hutchinson *et al.* 2003), can help to overcome the problem of resolving bilingual disputes. Noteworthy in this field is the European TELRI-project.[17]

Most ODR-providers offer their services in just one language, which is in the vast majority of cases English.[18] In Europe, for instance, a natural follow-up to the introduction of the EEJ-NET,[19] a clearing house redirecting EU inhabitants in their own language to ADR providers in the country in which the provider they have a dispute with is established, would be to actually solve the disputes online. Given the current 11 official EU languages there are 55 possible combinations of two languages. In case of multi-party disputes this number even increases. Without automated translation, the handling of the disputes cannot be solved easily.

6.2 Automated summarizing

During the last five years automated summarizing has become a lively branch of research (Moens 2002).[20] The current results are encouraging, though not yet good enough to be used on a commercial basis.[21] Given the fact that so many people are working on this topic, however, it is expected that in the next couple of years major progress will be made. Existing research programs are PRUDENTIA (Weber 1999), SALOMON (Moens, Uyttendaele & Dumortier 1999), and SMILE (Brüninghaus & Ashley 2001).

The possible applications in ODR of programs that automatically summarize are several, in particular because basically all information in ODR is available electronically.

The data of the summaries can be used for automated case management (what is the next step to be taken, who should be informed, what information should be provided, etc.), and in particular for automatically processing the complaints any ODR procedure starts with.

Also, the automatic generated brief summary of the main points of a, e.g. domain name, case can help in determining its relevance in case one is searching for precedents.

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16 <http://babelfish.altavista.com/>.

17 Trans-European Language Resources Infrastructure, <http://www.telri.bham.ac.uk/current.html>

18 Conley Tyler & Bretherton 2003.

19 <http://www.eejnet.org/en>.

20 Since 2000 the USA-based National Institute of Standards and Technology (NIST) organizes on a yearly basis the International Document Understanding Conference (DUC).

21 LexisNexis uses a semi-automated system to classify documents, including verdicts.

Communication with the parties can be facilitated, by adding a summary to any document or communication that exceeds a few lines. It is well-known that in an online environment people tend to read information only if it does not take too much time. If the most relevant information fall within the scope of their attention span, this could help solving the dispute.

6.3 Computer-mediated legal argument

DiaLaw belongs to a tradition in AI & Law research (e.g., Gordon, Loui, Nitta, Verheij) that is sometimes called mediation systems. Lodder (1999, p. 98-146) provides an overview of the research in this field. Confusingly, the word mediation is not used in the ADR/ODR sense, but means to emphasize the difference between these systems and systems that decide cases like expert systems. The research can be characterized as follows (Lodder & Verheij 1999):

"The starting point for the research on computer-mediated legal argument is that a computer system can support lawyers by mediating the process in which they draft and generate arguments: the system can administer and supervise the argument process by keeping track of the reasons adduced and the conclusions drawn, and by checking whether the users of the system obey the pertaining rules of argument, e.g., those related to the division of burden of proof."

One particular project that needs further mentioning is the Zeno system developed by Thomas Gordon and others (Gordon & Karacapilides 1997, Gordon & Märker 2003). Zeno is a internet discussion forum that facilitates the public inquiry procedure in municipalities. An issue such a discussion can be about is a zoning plan. Anyone is invited to bring forward his point of view. The Zeno system structures the discussion by showing the arguments pro and con. The system does not decide, but the information is used by the municipality to decide on the issue in dispute.

6.4 Intelligent agents

An intelligent agent is probably the AI application that appeals most to one's imagination. Before discussing some possible applications of agents in ODR, a short introduction into what agents actually are should be provided. There is a lot of Artificial Intelligence research dedicated to intelligent agents (Wooldridge & Jennings, Maes, etc.), software that can perform tasks autonomously. Due to this autonomous character agents are interesting from a legal perspective: lawyers struggle with the question whether agents are just instruments used by humans or legal entities that can perform legal acts. We are not going to discuss this issue, but concentrate on the practical application of agents in ODR.

Although the term intelligent agent becomes ever more pervasive, there is no unanimity on its meaning.[22] In the most appealing sense, an agent is seen as a *digital butler* (Negroponte 1995, p. 149-159). In this view, an agent is a little helper that sits inside a computer and that can do all kinds of things for its user: read e-mail, select news, order books, make flight reservations, etc. This implies, amongst others, that the agent has learning capabilities; the agent can learn the specific habits of its user and act accordingly. A lot of theories have been developed describing the key properties of intelligent agents. Most prevalent are Wooldridge and Jennings' (1995) *weak* and *strong* notions of agency. According to the weak notion an agent is a computer system that enjoys the following properties:

- autonomy: agents operate without the direct intervention of humans or others, and have some kind of control over their actions and internal state;

[22] Given the scope of this paper we can only give a short description of the theories on intelligent agents. For a more comprehensive overview, see Bradshaw 1997, p. 3-46.

- social ability: agents interact with other agents (and possibly humans) via some kind of *agent communication language*;
- reactivity: agents perceive their environment (which may be the physical world, a user via a graphical user interface, a collection of other agents, the internet, or perhaps all of these combined), and respond in a timely fashion to changes that occur in it;
- pro-activeness: agents do not simply act in response to their environment, they are able to take the initiative by their goal-directed behavior.

According to the strong notion of agency, an agent is a computer system that, in addition to the properties mentioned above, is envisioned using concepts that are normally applied to humans. For example, mental notions like knowledge, belief, intention and obligation are used. Furthermore, various other properties are mentioned, for example:

- mobility: the ability to move around in an electronic network;
- veracity: the assumption that an agent will not knowingly communicate false information;
- benevolence: the assumption that agents do not have conflicting goals, and that every agent will therefore always try to do what is asked of it;
- rationality: the assumption that an agent will act in order to achieve its goals, and will not act in such a way as to prevent its goals from being achieved – at least insofar as its beliefs permit

Peruginelli & Chiti (2002), referred to in the introductory section, have high expectations of agents. They present a theoretical framework in which the agent replaces the human mediator. This agent should manage all interaction between the parties, understand what the dispute is about, and, uncommon for most forms of mediation: formulate proposals. These proposals cannot (all) be compared to, e.g. SmartSettle's proposals, because they expect this automated mediator to go beyond mere numerically based proposals. Although the ideas are interesting, the state of the art in AI is ages away from what they want to realize, and therefore not very realistic.

The E-Arbitration-T project (Gouimenou 2002) aims to develop an architecture for online arbitration in which agents play a prominent role. In stead of communicating with the parties, the agents are expected to support the communication, documentation and negotiation between the parties in a way comparable to the 'digital' butler. This use of agents for information management is what we believe should be striven for in ODR.

Agents can be used to keep track of deadlines, organizing the documents of the case, and contacting other parties whenever appropriate. Another possible application of an agent is to search the internet for the most profitable or best qualified ODR-provider, or to retrieve documents, including information on similar cases, relevant for the dispute at hand.

7. Conclusion

Artificial Intelligence (AI) applications are a subset of IT applications. AI differs from ordinary IT in that an improvement is added either by using 'intelligent techniques' or by 'simply' performing in an intelligent way. Much of the research in AI has not left the laboratories, but once this happens, ODR could really benefit from the discussed applications. Skeptics might say that this moment will never come, but the signs are there that it will not take long before AI becomes a practical component of mainstream ODR. We don't expect the spectacular results tomorrow that are associated with the current common understanding of AI but we are convinced that the careful use of AI can already make ODR much more effective than it is today.

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