Bargaining in the shadow of the Law – using utility functions to support legal negotiation

John Zeleznikow	Emilia Bellucci	Uri J Schild	Geraldine Mackenzie
School of Information Systems, Victoria University, Melbourne, Victoria, Australia 61.3.99191815	School of Information Systems, Victoria University, Melbourne, Victoria, Australia 61.3.99194634	Dept. of Computer Science, Bar Ilan University, Ramat Gan, Israel 972-3-531-8716	Law School, Queensland University of Technology, Brisbane, Australia 61.7.3864 1099
John.Zeleznikow@vu.edu.au	Emilia.Bellucci@vu.edu.au	schild@cs.biu.ac.il	g.mackenzie@qut.edu.au

ABSTRACT

Most dispute resolution is settled by negotiation rather than litigation. However, such bargaining often occurs in the shadow of the law.

To help support interest-based negotiation, we explore the use of utility functions to support negotiation analysis. We discuss in detail a utility function we have developed in the area of family-law mediation. This function is currently being used as the basis of an online dispute resolution system.

Keywords

utility functions, negotiation support systems, bargaining in the shadow of the law.

1. INTRODUCTION

As Ross (1980) states *the principal institution of the law is not trial; it is settlement out of court.* To support this argument, Williams (1983) notes that whilst the figures may vary in different jurisdictions, of all the cases listed before the courts only about 5% of the cases are ever heard by the court and only 1% of the cases result in judicial decision-making.

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A survey in The Netherlands (Velthoven and Ter Voert 2004) indicates that about 48% of all disputes were settled out of court and just 4% is decided by litigation. Thus, a major goal of useful legal advice should be to avoid litigation. Nevertheless, most research in the domain of Artificial Intelligence and Law has focused upon *black letter law* – an informal term indicating the basic principles of law generally accepted by the courts and/or embodied in the statutes of a particular jurisdiction (Black 1990).

Negotiation is a process where the parties involved modify their demands to achieve a mutually acceptable compromise (Kennedy et al 1984). The essence of negotiation is that there is no third party whose role is to act as facilitator or umpire in the communications between the parties as they attempt to resolve their dispute (Astor and Chinkin 2002).

Folberg and Taylor (1984) define mediation as "a process by which the participants, together with the assistance of a neutral person or persons, systematically isolate disputed issues in order to develop options, consider alternatives, and reach a consensual settlement that will accommodate their needs". Mediation emphasises the separation of issues of the dispute and develops options for the disputants. Mediation most often is a voluntary and non-binding process in which a third party neutral assists the parties in formulating their own resolution of the dispute. It is a confidential process in which the confidentiality is protected by an agreement between the parties and the mediator or by statute (such as in Australia). The fundamental difference between negotiation and mediation is the presence of an impartial, neutral third party who is not a partisan for one of the disputants but rather assists both or all the parties towards reaching an agreement (Astor and Chinkin 2002).

(Beardsley et al 2006) identify three forms of mediation: a) facilitative mediation – where mediators help the parties communicate but do not intervene in the proceedings; b) formulation – here mediators make a substantial contribution to the negotiation, they can perceive and propose new solutions; c) manipulative mediation – here the mediator uses his position and leverage to influence the outcome.

Whilst the concept of negotiation has a long history[1], the modern Alternative Dispute Resolution movement can be traced back to Sander (1976). Mnookin and Kornhauser (1979) introduced the bargaining in the shadow of the trial concept. By examining the case of divorce law, they contended that legal rights of each party could be understood as bargaining chips that can affect settlement outcomes. Bibas (2004) has noted that some scholars treat plea-bargaining as simply another case of bargaining in the shadow of a trial.

The concept of bargaining in the shadow of the law is significant in the context of the negotiation of disputes. We shall introduce the notion of a utility function as a method for supporting such bargaining. We examine, in detail, the utility function we have developed for interest-based negation in the field of family law. We conclude by examining our current research on plea-bargaining.

2. NEGOTIATION AND BARGAINING IN THE SHADOW OF THE LAW

Walton and Mckersie (1965) propose that negotiation processes can be classified as distributive or integrative. In distributive approaches, the problems are seen as "zero sum" and resources are imagined as fixed: *divide the pie*. In integrative approaches, problems are seen as having more potential solutions than are immediately obvious and the goal is to *expand the pie* before dividing it. Parties attempt to accommodate as many interests of each of the parties as possible, leading to the so-called *win-win* or *all gain* approach. As (Kersten 2001) notes although Walton and McKersie did not suggest one type of negotiation being superior to the other, over the years, it has become conventional wisdom that the integrative type allows for *better compromises*, *win-win solutions*, *value creation* and *expanding the pie*. (Fisher and Ury 1981) and (Lax and Sebenius 1986) discuss these issues in detail.

Game theory, as opposed to behavioural and descriptive studies, provides formal and normative approaches to model bargaining. One of the distinctive key features of game theory is the consideration of zero-sum and non-zero-sum games. These concepts were adopted to distinguish between distributive and integrative processes. Limitations of game theory in providing prescriptive advice sought by disputants and their advisers on one hand, and the developments in multicriteria decision-making and interactive methods on the other, provided the groundwork for negotiation analysis as discussed in (Raiffa 1982).

(Bibas 2004) argues that *the conventional wisdom is that litigants bargain towards settlement in the shadow of expected trial outcomes. In this model, rational parties forecast the expected trial outcome and strike bargains that leave both sides better off by splitting the saved costs of trial. … This shadow of trial model now dominates the literature on civil settlements*. In developing the concept, Mnookin and Kornhauser (1979) treated the legal rights of each party as *bargaining chips* that affect settlement outcomes.

Cooter et al (1982) discuss this issue for civil cases. Posner (1973) claims that the usual approach to bargaining in the legal setting assumes that trial is caused by excessive optimism on behalf of both the plaintiff and the defendant. Posner (1995) focuses upon legal pragmatism and law and economics. He views law not as formalistic argumentation, but as competition for resources. Under this model the competing parties have a utility function which they attempt to maximize.

In discussing notions of justice in negotiation, Byrne and Cropanzano (2001) consider distributive, procedural and interactional justice. Distributive justice concerns what is just or right with respect to the allocation of goods in a society. (Fletcher 1996) notes that distributive justice relies on the assumption that a central authority has control over all things, good and bad, that can be possessed. The act of distribution is designed to realise a just relationship amongst two or more claimants.

Procedural justice is concerned with making and implementing decisions according to fair processes. (Rawls 1971) argues that if the procedures for choosing principles of justice are fair, then the outcome will be just. Interactional justice considers the degree to which the people affected by a decision are treated with politeness, dignity, and respect. It focuses on the interpersonal treatment people receive when procedures are implemented. In a related project, discussed in section 5, we are investigating the notions of procedural and distributive fairness in negotiations.

In most legal domains, dispute resolution focuses upon bargaining in the Shadow of the Law, rather than integrative bargaining. This point will be highlighted in our discussion of family mediation decision support systems.

Given our goal is to provide tools to support negotiation, rather than merely replicate legal decision-making, we need to examine the notions of BATNAs and utility functions. In this paper we do not present a formal model on how to use utility functions in dispute resolution. Rather, we argue that mediators and negotiators intuitively use certain techniques that inherently rely upon utility functions. Thus we argue that an examination of utility functions is vital. Our work on the Family_Winner and Family_Mediator projects (Zeleznikow and Bellucci 2006) is merely one such example.

2.1. Developing BATNAs

Fisher and Ury (1981) introduced the notion of a *BATNA* (*B*est *A*lternative *T*o a *N*egotiated *A*greement) concept as a tool for negotiators to cope with power imbalances. They claim that, if negotiators do take account of their options outside a negotiation, they are better protected against agreements that should be rejected. It also helps them to reach agreements that better satisfy their interests. In order to assess whether an offer should be rejected, a party in a dispute has to establish what can be accomplished in alternative procedures to the one currently being conducted. Once the alternatives are known, these can be compared to what one expects to win by accepting an offer in the current procedure.

In their development of a three step model for Online Dispute Resolution, (Lodder and Zeleznikow 2005) evaluated the order

[1] For example, Abraham and God negotiating in the Torah (or old Testament) re criteria for destroying Sodom and Gomorrah

in which online disputes are best resolved. They suggested the following sequencing:

1) First, the negotiation support tool should provide feedback on the likely outcome(s) of the dispute if the negotiation were to fail – i.e. the BATNA.

2) Second, the tool should attempt to resolve any existing conflicts using dialogue techniques.

3) Third, for those issues not resolved in step two, the tool should employ compensation/trade-off strategies in order to facilitate resolution of the dispute.

4) Finally, if the result from step three is not acceptable to the parties, the tool should allow the parties to return to step two and repeat the process recursively until either the dispute is resolved or a stalemate occurs.

The model suggests that an important first step in providing negotiation decision support is developing relevant BATNAs.

2.2. BATNAs for Family Mediation and Plea-bargaining

In the Split-Up project (Stranieri *et al* 1999) wished to model how Australian Family Court judges exercise discretion in distributing marital property following divorce. They used machine learning to model how judges perform the distribution. Whilst the Split—Up system was not originally designed to support legal negotiation, it is capable of doing so. Split—Up can be directly used to proffer advice in determining your BATNA. (Bellucci and Zeleznikow 2001) illustrate this point.

Plea-bargaining is the process whereby the accused and the prosecutor in a criminal case work out a mutually satisfactory disposition of the case subject to court approval (Black 1990). It usually involves the defendants pleading guilty to a lesser offence or to only one or some of the counts of a multi-count indictment in return for a lighter sentence than that possible for the graver charge. Without the concept of plea-bargaining, the United States Criminal system would grind to a halt. In the United States, Baldwin and McConville (1977) estimate that approximately 90% of guilty pleas are negotiated.

Hall et al (2005) built a sentencing decision support system to help new defence lawyers at VLA make arguments to support their clients to receive the least onerous sentences. . The system uses a combination of decision trees and argument trees (as proposed by (Toulmin 1958)).

Vincent and Zeleznikow (2007) are constructing a plea negotiation support environment for Contest Mentions in the Victorian Magistrates' Court and more broadly plea negotiations in other jurisdictions. The current system is intended to be used by VLA lawyers to support plea negotiations and train inexperienced advocates. The system consists of two major parts. The first part is a sentencing decision support system which provides information as to possible range of sentences and also the probability of attaining the recommended sentence. The second part is an environment for plea negotiation. In this latter task, we are developing utility functions to support making trade-offs.

Enhanced negotiation support can be provided by decision support systems. Decision support systems can provide an unbiased appraisal of an accused person's situation. This can be performed by the provision of a BATNA, especially with respect to a possible sentence at the final disposition of the case. Organizing and prioritising the most important aspects for an appropriate outcome can bring about effective negotiation support. Considerations such as not receiving a conviction or keeping a fine as low as possible can be ordered and prioritized.

Whilst others may disagree we view plea-bargaining as a form of negotiation that has benefits of administrative efficiency for the prosecution and provides certainty for the defence. Of course plea bargaining can have negative consequences. Gazal-Ayal (2006) investigates the economics of plea bargaining. He proposes having a partial ban on plea bargains, which prohibits prosecutors from offering substantial plea concessions. He argues that such a ban can act to discourage prosecutors from bringing weak cases and thus reduce the risk of wrongful convictions. Wright and Miller (2003) believe that pervasive harm stems from charge bargains due to their special lack of transparency. They argue that charge bargains, even more than sentencing concessions, make it difficult after the fact, to sort out good bargains from bad, in an accurate or systematic way.

The recent case of David Hicks, an Australian citizen, captured in Afghanistan and held in Guantanamo Bay for five years as an unlawful combatant, illustrates the dangers of plea-bargaining. On March 26 2007, Hicks entered a guilty plea to the charge of providing material support for terrorism. Part of the bargain was that Hicks not communicate with the media for twelve months (coincidentally after a forthcoming Australian election). The sentence appears lenient for the crime to which Hicks pleaded guilty. On the other hand, if Hicks was coerced into pleading guilty, that would be a serious miscarriage of justice.

Of course[2] whilst BATNAs inform disputants' decision-making, other factors are also taken into account. These might include the cost of the trial (such as paying for lawyers, expert witnesses and in Australia the loser in a civil case pays the winner's costs) the length of the trial, the emotional stress that the trial might place on the litigants and the danger that a judicial verdict might set a negative precedent for one of the litigants.

In (Zeleznikow et al 2007) we investigate bargaining in the Shadow of the Law as one technique for dispute resolution. In (Gray et al 2007) we investigate using integrative bargaining and the E-Ganges system to provide negotiation planning: planning to avoid rather than resolve disputes. In this article, we argue that understanding utility functions is an important concept for developing negotiation support systems.

3. UTILITY FUNCTIONS

Utilitarianism was propounded by Jeremy Bentham and his followers. The principle of utility or 'greatest happiness' mandates actions which produce the greatest sum of happiness (or pleasure or preference-satisfaction) as added up for the citizenry in the aggregate (Bentham 1789). The concept of utilitarianism as advocated by Bentham is in fact the basis of integrative or interest-based negotiation as proposed by Walton

[2] As an anonymous referee poignantly noted

and McKersie. It is distinct from the zero-sum games (or indeed often lose-lose games once the cost of litigation is taken into account) of litigation.

(von Wright 1972) claims that preferences are an important object of study in economic theory. Modern decision theory has developed the new conceptions of utility functions and personal probabilities. In current economics and in decision theory, the utility of outcomes and attributes refers to their weight in decisions: utility is inferred from observed choices and is in turn used to explain these choices. Thus utility is a measure of the relative satisfaction gained by consuming different bundles of goods and services.

More specifically, in the INSPIRE negotiation project (Kersten 2001), a utility function is a subjective measurement that expresses the relative value of different package by using a numerical scale. The minimum number expresses the least desirable and least preferred package. The highest number represents the most desirable and preferred package.

(Wright 1999) states there is no independent weight given in the utilitarian theory to the distribution of happiness (or wealth or power) or to the promotion of individuals' equal (positive and negative) freedom. (Raiffa 1982) argues that there are very few researchers who prefer to trust the recommendations of formal utility theory rather their own intuition. We do not argue that utility theory is the panacea for building interest-based negotiation support systems. However, models that use utility theory can provide useful negotiation advice.

In our discussion of utility functions, we focus upon the interests (in terms of optimizing their utility function) of the disputants, rather than being concerned with the interests of society. In particular we shall focus upon a sophisticated utility function which we have developed to support family mediation. We argue that a generalization of this function can be used to support online dispute resolution.

Lawyers have been reluctant to use utility functions, because in general they are reluctant to commit themselves to general principles which could then be evaluated by users of legal services. Researchers in the psychology of decision-making (see (Raiffa 1982) and (Kahneman and Tversky 1979)) have extensively used utility functions to model decision making. (Pratt et al 1964) jointly axiomatized utility and subjective probability as a prescriptive theory to guide decision making. (Raiffa 1968) illustrated that these ideals were operational.

Utility functions are at the basis of negotiation decision support systems. Whilst not directly mentioning utility functions, (Allen 1956) proposed the use of game theory to support labour negotiations. He used game theory developed by von Neumann and Morgenstern (1944) and adapted by Nash (1950) to model bargaining situations.

Utility functions have been heavily used in economics. Their significance in this domain can be seen by the awarding of Nobel Prizes to Kenneth Arrow (1972), Herbert Simon (1978), John Nash (1994) and Daniel Kahnemann (2002). The main use of utility functions in law has been in the area of Law and Economics. One of the major proponents of this approach has been Richard Posner (see (Posner 1998)).

We cannot develop a generic utility function to be used in law. However, we do believe that utility functions in specific areas of law can be very useful. For example, developing utility functions so that traffic fines can be determined which consider not only the nature of the offence, but on how the fine might affect the offender in terms of their personal financial situation, would be an important contribution for developing *just* legal systems.

3.1. Some of examples of utility functions in legal domains

Whilst utility functions have not been widely used in the legal domain, they do have some advocates.

(Behrman and Davey 2001) developed utility functions for evaluating the value of eye-witness identification. Their study analyzed 271 actual police cases in order to address several prevalent issues in the eyewitness literature. Suspect identification rates were obtained for 289 photographic lineups, 258 field showups, 58 live lineups, and 66 lineup identifications preceded by earlier identifications. Suspect identification rates were assessed for 3 levels of extrinsic evidence: no extrinsic evidence, evidence of minimal probative value, and evidence of substantial probative value. The suspect identification rates for the photographic lineups were assessed as a function of delay, same vs. cross-race conditions, witness type, and weapon presence. Suspect identification rates declined significantly over time; suspect identification rates were significantly greater for the same-race condition. Suspect identification rates were much greater for field showups than photographic lineups, 76% vs. 48%

(Jouini et al 2005) consider the problem of optimal risk sharing of some given total risk between two economic agents characterized by law-invariant monetary utility functions. They provided an explicit characterization in the case where both agents' utility functions are co-monotone.

(Posner 1993) examined how to explain judicial behaviour in economic terms. He argued that judges' voting behaviour should be conceptualised by consumption and that judges avoid the hard work and hassle involved in writing opinions.

(Foxall 2004) developed a judicial utility function which included judicial and non-judicial income and consumption. Part of the consumption occurs during leisure time but a proportion occurs in working time (e.g. voting, reputation, avoidance of criticism). He argued that the extent to which a judge experiences judicial work as laborious depends on her cognitive style: adaptors and innovators are expected to conceptualise and experience the detailed work of opinion writing in different ways and thus to have distinct preferences for competing sources of utility.

(Gazal-Ayal 2006) proposes having a partial ban on plea bargains, to discourage innocent defendants from pleading guilty. He argues that the law can address this concern by providing prosecutors with incentives to select cases for a plea bargain in which the probability of guilt is high. By restricting the permissible sentence reduction in a plea bargain the law can preclude plea bargains in cases where the probability of

conviction is low (L cases). The prosecutor will therefore be forced to – (1) select fewer L cases and proceed to trial with these cases; or (2) select more cases with a higher probability of conviction (H cases) that can be concluded via a less-costly plea bargain. As long as the probability of conviction is positively correlated with the probability of guilt, this selection-of-cases effect implies a reduced number of innocent defendants will accept plea bargains.

(Gazal-Ayal 2006) and (Bar-Gill and Gazal-Ayal 2006) have developed utility functions to support plea-bargaining through the use of partial differential equations.

4. UTILITY FUNCTIONS AS USED IN FAMILY MEDIATION

4.1. The Family_Winner system

Bellucci and Zeleznikow (2006) observed that an important way in which family mediators encourage disputants to resolve their conflicts is through the use of compromise and trade-offs. Once the trade-offs have been identified, other decision-making mechanisms must be employed to resolve the dispute. They noted that while it appears counterintuitive:

- The more issues and sub-issues in dispute, the easier it is to form trade-offs and hence reach a negotiated agreement, and
- They choose as the first issue to resolve the one on which the disputants are furthest apart – one party wants it greatly, the other considerably less so.

In assisting the resolution of a dispute, Family_Winner (Belluci and Zeleznikow 2006) asks the disputants to list the items in dispute and to attach importance values to indicate how significant it is that the disputants be awarded each of the items. The system uses this information to form trade-off rules. The trade-off rules are then used to allocate issues according to a "logrolling" strategy[3].

Family_Winner accepts as input a list of issues and importance ratings that represent a concise evaluation of a disputant's preferences. In forming these ratings, the system assumes that the disputants have conducted a comparison of the issues. As noted by (Sycara 1993), bargainers are constantly asked if they prefer one set of outcomes to another. Thus Sycara suggests considering two issues at a time, assuming all others are fixed. Family_Winner uses a similar strategy in which pair-wise comparisons are used to form trade-off strategies between two issues.

The trade-offs pertaining to a disputant are graphically displayed through a series of trade-off maps (Zeleznikow and Bellucci 2003). Their incorporation into the system enables disputants to visually understand trade-off opportunities relevant to their side of the dispute. A trade-off is formed after the system conducts a comparison between the ratings of two issues. The value of a trade-off relationship is determined by analyzing the differences between the parties, as suggested by (Mnookin et al 2000).

Consider as an example a family law dispute in which the wife is awarded the marital home and the husband awarded the holiday house. Depending on how the husband and wife rated various issues, one might be compensated following the allocation of property to the other. Compensation is considered as an external reward, one that is not related to the issues on the table. Family_Winner awards compensation to parties that have either lost an issue they regard as valuable, or have been allocated an issue of little importance.

The system implements compensation by either increasing or decreasing a party's rating. It is then expected that changes made to a rating will influence the decision of a future allocation. The amount of any compensation resulting from the triggering of a trade-off has been empirically determined from an analysis of data. This means that even though we have tried to explicitly define utility functions, they are indeed developed implicitly and are only approximations.

The input consists of:

- Issues in dispute. Both disputants are requested to enter the issues in dispute. The issues may consist of a series of sub-issues.
- Ratings. Once the issues and sub-issues have been established, the user enters numbers that reflect the importance of an issue or sub-issue (this is called a rating).
- Mutual Exclusiveness. An issue is mutually exclusive of another issue, if as a result of allocating one issue, both issues are allocated simultaneously. For example, the issues of primary residency and visitation rights to children are mutually exclusive, since if one parent has residency, then the other, save for exceptional circumstances, is allocated visitation rights.

Unlike the case of input, the method by which output is presented by the system is not characterised by a sequential standard process. These outputs include:

- Trade-off Maps. Once new information has been entered into the system, or changes occur in the negotiation (for example to ratings following an allocation), the system displays two Trade-off Maps. Each map represents the preferences and trade-offs pertaining to a party. These diagrams provide disputants with an opportunity to diagrammatically assess their position in relation to all other issues.
- Summary Report. Once an issue has been allocated to a party, a summary report describing the current state of issue allocation with respect to the preferences of both parties is displayed. The summary report lists the issue recently allocated and the party to which it is allocated, all prior allocations, the value of issues before allocation and their current value, and a hierarchical map of all issues yet to be resolved.

Family_Winner uses the Issue Decomposition Hierarchy (as described in (Bellucci 2004)) to store all issues (and sub-issues) and makes use of Trade-off Maps to deliver a compensation

[3] Logrolling is a process in which participants look collectively at multiple issues to find issues that one party considers more important than does the opposing party. Logrolling is successful if the parties concede issues to which they give low importance values. See (Pruitt 1981).

strategy. The output consists of a list of allocations, which form the basis of the advice provided by the system.

4.2. Family_Winner's utility function

We now give an implicit description of utility functions developed for the Family_Winner System. A discussion of the additional Family_Mediator utility function will be held in section 4.3.

4.2.1. Defining the problem

The set of issues in dispute is: $D = X \cup Y$ where $X = \{X_1, X_2, \ldots, X_n\}$ is the set of issues that H sees as in dispute and $Y = \{Y_1, Y_2, \ldots, Y_m\}$ is the set of issues that W sees as in dispute. H and W give a significance value (rating) to each of the issues in $D = \{D_1, D_2, \ldots, D_k\}$ where m, n $\leq k \leq m + n$. These significance values (or ratings) are denoted $x_D = \{x_{D1}, x_{D2}, \ldots, x_{Dk}\}$ and $y_D = \{y_{D1}, y_{D2}, \ldots, y_{Dk}\}$ respectively.

The function [1] normalises each party's significance values, so that they both sum to one hundred.

$NEW(x_{Di}) = (x_{Di} * 100)/ \Sigma x_{Di}$ and $NEW(y_{Di}) = (y_{Di} * 100)/ \Sigma y_{Di}$ where $i \varepsilon \{1, 2, \ldots, k\}$ **[1]**

Each issue can be decomposed into sub-issues $D_i = \{D_{i,1}, \ldots, D_{di,,g(i)}\}$, where g(i) is the number of sub-issues for issue D_i.

The rating of an issue refers to the value of an issue to a party. The rating of a parent issue is its numerical rating provided by disputants, while the rating of a sub-issue is represented by a percentage of the parent issue's rating. The value of sub-issues, with respect to the rating of their parent issues is calculated next and is defined as a P-rating.

So the initial issue (such as *child welfare*) is now deleted from the list of issues to be considered and replaced by the sub-issues. The p-ratings take into account the ratings of both issues and sub-issues. P-ratings incorporate the influence of a parent issue to form the rating of a sub-issue. P-ratings are calculated according to the following equation:

If sub-issue D_i is given ratings $\{x_{Di,1}, \ldots, x_{Di,g(i)})\}$ where $\Sigma x_{Di,j} = 100$; and $\{y_{Di,1}, \ldots, y_{Di,g(i)})\}$ where $\Sigma y_{Di,j} = 100$; then the p-rating for $X_{di,j}$ is $x_{di} * x_{di,j} /100$ and the p-rating for $Y_{di,j}$ is $y_{di} * y_{di,j} /100$ **[2]**

It should be noted that only the ratings of the initial issues and sub-issues are normalised. So after the initial normalisation, there is no reason why ratings or subratings should sum to 100.

Example: Suppose, Party H gives issue1 a rating of 60, and issue2 a rating of 40. Suppose further that issue 1 has sub-issues 11 and 12 and that party H gives them ratings of 10 and 90 respectively. Then Issue11 has a p-rating of 6 (10% of 60 = 6), and Issue12 has a p-rating of 54 (90% of 60 = 54).

4.2.2. Choosing the order of allocation

The order in which issues are considered for decomposition or allocation is then calculated. Specifically, the function described in [3], choose(i) calculates the numerical difference between the ratings set by both parties towards the same issues.

Let set $D^* = \{d_1, d_2, \ldots, d_k\}$ be the set of differences between the ratings of the issues in dispute, where $d_i = |x_{Di} - y_{Di}|$ with $i \varepsilon \{1, 2, \ldots, k\}$. The issue with the highest d_i value will be presented first.

choose(1) = max $\{d_i: 1<= i <= k\}$

The choose function, choose (i), for i > 1, will operate on revised ratings. So choose(2) will be the maximum of the differences in revised ratings with: (a) The first issue allocated is removed from the list of revised ratings; (b) The revised ratings following the allocation of the first issue are used. The function is defined recursively. **[3]**

A brief discussion of revised ratings will be conducted in 4.2.5. The mediators and disputants can choose to either decompose the issue into sub-issues or directly allocate it.

Example: Suppose Party H has issue1 with value of 60, issue2 with value of 40 and issue3 with a value of 0. Party W has issue1 with a value of 50, issue2 with a value of 30 and issue3 with a value of 20. The difference calculation for issue1 is 10, while the corresponding calculation for issue2 is 10 and the corresponding calculation for issue3 is 20. Therefore D is the set {10,10,20}. Since issue3 has the highest value of 20 in set D, the system will suggest to the disputants that they negotiate over issue3 first.

4.2.3. Allocating Issues

Once a decision on which issue to distribute has been made, the issue needs to be distributed. In the above example, issue3 is distributed first. H had a rating of 0 for issue3 whilst W gave it a rating 20. Thus W is awarded issue3. H needs to be compensated because W is awarded issue3.

Thus at any step, we need a function to keep a record of how many points each disputant has received at time t. Let us call this function GAIN(z,t). Our eventual goal is to have GAIN(H,FINAL) fairly close to GAIN(W,FINAL). **[4]**

In the example above, GAIN(H,1) = 0 and GAIN (W,1) = 20.

4.2.4. The top level utility function

If an issue does not require decomposition or has been sub-divided appropriately, the issue is allocated according to the issue's importance rating. The ratings of issues are hence compared. Essentially, the party whose rating is greatest is allocated the issue. If the ratings are of equal value, then the next issue to be considered for allocation is presented. Formally, this algorithm is presented as follows:

If $x_{Di} \geq y_{Di}$ then issue i is allocated to H, else issue i is allocated to W, where $i \varepsilon \{1, 2, ..., k\}$ **[5]**

Once an issue (or issues) has been allocated, the remaining issues are affected to varying degrees, according to trade-offs executed as a result of the allocation. The extent to which the ratings of issues change is dependent on whether an issue is lost or gained, the ratings of issues forming trade-offs, and strength of the trade-off (represented by relationship figures). The values of these variables are combined to form a series of graphs, used to extract the amount of change affecting ratings.

4.2.5. Performing Trade-Offs

Once the issues and sub-issues have been allocated we need to perform trade-offs to compensate the loser of the issue or sub-issue. To support the awarding of compensation, we develop Trade-off Maps. These diagrams are indicative of possible trade-offs between pairs of issues.

The trade-off maps were empirically developed using data provided to us by four different sources: (a) Thirty-six surveys of mediator questionnaires obtained from the department of Law and Legal Studies at La Trobe University; (b) a series of interviews conducted with four Family Law mediators from the Family Mediation Centres in both Noble Park and Ringwood, Victoria, Australia; (c) a set of six hundred mediation transcripts provided by the Australian Institute of Family Studies (d) Family Law negotiation simulations we conducted, held in conjunction with the Law School at Monash University, Melbourne, Australia and with the Graduate School of Business at Bar-Ilan University in Ramat Gan, Israel.

A detailed discussion of trade-off maps can be found in (Bellucci 2004). It involves a discussion of the Analytical Hierarchy Process (Saaty 1980) and the development of a matrix of pair-wise comparison of issues and sub-issues.

The utility function which advises upon the allocation of issues to H and W is given in [5]. [1] performs normalization, [2] calculates p-ratings, [3] defines the metric which is used to decide which issue is first allocated, whilst [4] stores the sum of the values that each party has received. A brief discussion of how ratings are revised using trade-off maps is also given. There is no claim that the functions are in any way optimal.

The utility functions developed in the Family_Winner project try to improve the user's satisfaction with the family mediation process. Thiessen and MacMahon (2000) developed the SmartSettle system which is also a negotiation support that models integrative bargaining. There is no claim that the function is optimal. The Family_Winner algorithm was evaluated in (Bellucci and Zeleznikow 2006).

Following advice from family-law lawyers and mediators at Victoria Legal Aid and Relationships Australia, we always choose Child Welfare Related issues as the first issue to be allocated. However, in our generic model of the development of decision support systems for bargaining in the shadow of the law, we make no such presumption.

4.3. The Family_Mediator System – adding facilitation the Family_Winner system

The Family_Winner system was designed to help mediators provide advice about dispute resloution through the use of trade-offs. The system focused upon trying to determine each of the disputant's interests and then uses utility or game theory to suggest good solutions (not necessarily optimal). It is an example of facilitative mediation.

However, Australian family law focuses upon the paramount interests of the children, not upon the interests of the parents. Thus family law mediators need to influence the parents to propose a settlement that best meets the needs of the children. Hence, family law mediators are engaging in formulation rather than in facilitative mediation.

The Queensland Branch of Relationships Australia wants to use a modified version of Family_Winner to provide decision support for their clients. The application domain concerns agreements about the distribution of marital property. Instead of Family_Winner attempting to meet both parents' interests to basically the same degree (i.e. have GAIN(H,FINAL) fairly close to GAIN(W,FINAL), mediators at Relationships Australia determine what percentage of the common pool property the wife should receive (e.g. 60%). This advice can also be tendered by the Split_Up system.

A major issue of concern to Relationships Australia is how to equate the percentage of property with the interests of the couple. It is not necessary that there be a direct connection between the financial value of an item and the points-value that each party in the dispute attaches to the item. Indeed, a major issue in dispute may involve determining the value of the item. For example following a divorce, the husband may agree that the wife should be awarded the marital home. In this case it would be in his interests to overvalue the house (say he suggests it is worth $1,200,000) whilst it is in the wife's interests to undervalue the house (say she suggests it is worth $800,000). So how can our new system (Family_Mediator) help resolve the issue?

Our strategy is: **[6]**

a) The mediator involved in helping resolve the dispute makes decisions about how many points the husband and wife should each receive. The mediator could use the Split_Up system if this is seen as beneficial. Say the wife receives X% and Husband (100 – X) %.

b) The mediator decides on the financial value of each item in dispute.

c) Both the Husband and Wife give points to each of the items in dispute[4].

d) The Family_Mediator system then suggests trade-offs and compensations so that the wife receives T*(50 + X) points and the husband receives T*(150 - X) points where T is the number of points each party would receive under the original Family_Winner system.

The new utility function developed in Family_Mediator (which is defined in (a), (b), (c), (d) of [5]) allows the concept of interest-based negotiation as developed in Family_Winner to be integrated with notions of justice.

5. FUTURE RESEARCH AND CONCLUSION

Whilst (Ross 1980) claims the principal institution of the law is not trial; but settlement out of court, nevertheless, legal negotiation often occurs in the shadow of the law. Disputants

[4] As in the entering of the points into the Family_Winner system, the points should sum to 100. If this is not the case, then the numbers are scaled so that they sum to 100.

often calculate their BATNAs and then conduct interest-based negotiation to achieve their goals.

We have seen that utility functions can provide useful decision support for conducting the trade-off process interest based facilitative mediation. As part of a project on supporting trade-offs and compromises for integrative bargaining, we have developed utility functions that advise upon family-law mediation. The utility functions try to improve the user's satisfaction. There is no claim that the function is optimal. An extension of Family_Winner, Family_Mediator engages in formulative mediation.

The Family_Winner algorithm was evaluated in (Bellucci and Zeleznikow 2006).

In (Lodder and Zeleznikow 2005) we have shown how the family-mediation utility function can be extended to a generic online dispute resolution environment. In conjunction with a commercial partner (Creative Binary Engineering) we are developing a generic web-based system to provide advice about dispute resolution using an interest-based approach.

As noted in section 2.2, plea-bargaining can be seen as a form of negotiation that has benefits of administrative efficiency for the prosecution and provides certainty for the defence. Generally, the interests of the parties focus upon reduced sentences and reducing costs. In other negotiation domains, in particular industrial relations and family relationships, more complex trade-offs can be employed to meet the parties' interests.

The Australian Workplace Relations Amendment (Work Choices) Bill 2005 encourages employers and employees to conduct direct negotiations about employment conditions. Previously, under a centralized decision-making process, the Australian Industrial Relations Commission made ruling on disputes. Whilst the new legislation creates a Fair Pay Commission to ensure that all agreements meet five basic principles, the new legislation encourages interest-based negotiation rather than arbitrated or judicial decisions. It is thus an excellent domain in which to use utility functions to provide Negotiation Decision Support. In conjunction with the School of Applied Economics at Victoria University, we are building a tailored system adapted from our generic web-based system to advise upon enterprise bargaining.

In a related project, we are investigating principles for the successful negotiation of Information Technology Outsourcing Agreements.

5.1. Future Research

We are about to commence a project that investigates the fairness and consistency of negotiation support systems in the legal domain. In a project with title 'Developing negotiation support systems in law which encourage more consistent and principled outcomes' we argue that unless negotiation support systems are seen to advocate outcomes which arise from consistent and principled advice, disputants will be reluctant to use them. Thus we propose conducting research that will develop measures for assessing the outcomes of online negotiation in the legal domains of sentencing, plea bargaining and family mediation. Such measures will form the basis of a new model for evaluating justice and consistency within online dispute resolution systems. The model will inform the construction of fairer and more consistent systems of IT-based negotiation support in the future.

To meet this goal we will:

1. Develop models of consistency and justice based on two very distinct legal domains: sentencing and family law. Further, the knowledge about these domains will be shared from three distinct Common Law jurisdictions: Australia, Israel and USA.
2. Develop information retrieval techniques to extract knowledge from textual legal and negotiation data.
3. Use KDD techniques (such as association rules, Bayesian belief networks and neural networks) to compare litigated and negotiated family law cases.
4. Develop models of disputation and negotiation in both family law and sentencing. These models will then be tested to examine how closely they align with the notion of Bargaining in the Shadow of the Law (as compared to 'pure' interest-based negotiation).
5. Use Lodder and Zeleznikow's three step model for an Online Dispute Resolution Environment and Toulmin's theory of argumentation to construct a generic online dispute resolution environment. The development of such an environment on which to place various negotiation support systems will increase users' access to justice.
6. Develop and evaluate specific sentencing and negotiation support systems using our newly developed Online Dispute Resolution Environment.

In a second project, in conjunction with industry partners Relationships Australia and Victoria Body Corporate we are developing negotiation support systems to enable the continuation of constructive relationships following disputes. Relationships Australia is one of Australia's primary providers of family counseling and family mediation services. Its Queensland branch (http://www.relationships.com.au/who-we-are/state-and-territory-organisations/qld) runs Family Relationship Centres. Mr. Shane Klintworth, director of the Queensland Branch of Relationships Australia became aware of the interest-based negotiation support system Family_Winner when it won the ABC Television show section of the New Inventors program (http://www.abc.net.au/newinventors/txt/s1504763.htm) screened on 16 November 2005. Mr. Klintworth saw the benefits to Relationships Australia of a system that could enhance interest based negotiation. However, he also saw the need to emphasise the paramount interests of the children in any system. While meeting parental desires is important, meeting children's needs is paramount. Further, especially when the divorcing couple has children, it is vital to encourage a harmonious on-going relationship between the parents.

Victoria Body Corporate (http://www.vbcs.com.au/) a medium size company offering personalised management services to bodies corporate, strata title units and company share properties. A major facet of its role is the successful resolution of disputes amongst body corporate members. Because, in general, the disputants live in the body corporate (and hence in close proximity to each other) it is important that disputes be resolved so that the body corporate members can continue with harmonious relationships. With this in mind, Mr. Herman Klein, director of Victoria Body Corporate (VBC) wishes to develop software that can help his managers amicably resolve

disputes. Mr. Klein also believes that the innovative application of negotiation support systems will give him a marketing advantage over other body corporate companies.

In this project we wish to combine integrative bargaining, bargaining in the shadow of the law and formulation to develop decision support systems that support mediation and negotiation, specifically in body corporate and family disputes. We will:

a) develop negotiation support systems that support formulation: both in Family Law and Body Corporate disputes. The systems will respect ethical and legal principles and rely upon processes that are not only fair but are perceived by the parties to be fair.

b) construct negotiation support systems that provide planning advice to help avoid disputes rather than resolve conflicts.

c) develop an integrated Online Dispute Resolution environment that provides relevant legal knowledge, allows for communication and provides decision support tools.

d) Use knowledge discovery from databases techniques to try and learn how mediators provide advice.

e) Use the techniques of Hall et al (2003), to thoroughly evaluate and re-engineer our negotiation support systems.

6. REFERENCES

Allen, L. E. 1956. Games Bargaining: A Proposed Application of the Theory of Games to Collective Bargaining, *Yale Law Journal*, 65(5): 660-693

Astor, H. and Chinkin, C.M. 2002, *Dispute resolution in Australia*, 2nd edn, LexisNexis Butterworths, Sydney.

Baldwin, J. and McConville, M. 1977. *Negotiated Justice: Pressures to plead guilty*. Martin Robertson (Law in Society Series).

Bar-Gill, O. and Gazal-Ayal, O. 2006. Plea-bargaining only for the Guilty. *The Journal of Law & Economics*, 49:353-364.

Beardsley, K., Quinn, D., Biswas, B. and Wilkenfeld, J. 2006. Mediation Style and Crisis Outcomes. *Journal of Conflict Resolution*, 50(1): 58-86.

Bellucci, E. 2004. Developing Compensation Strategies for the construction of Negotiation Decision Support Systems. PHD thesis, La Trobe University, Bundoora 3086, Victoria, Australia

Bellucci, E. and Zeleznikow, J. 2001. Representations for decision making support in negotiation. *Journal of Decision Support*. volume 10(3-4): 449-479

Bellucci, E and Zeleznikow, J. 2006, Developing Negotiation Decision Support Systems that support mediators: a case study of the Family_Winner system, *Journal of Artificial Intelligence and Law*, 13(2): 233-271.

Behrman, B. W. and Davey, S. L. 2001. Eyewitness Identification in Actual Criminal Cases: An Archival Analysis. *Law and Human Behaviour*, 25(5): 475-491.

Bentham, J. 1789. *An Introduction to the Principles of Morals and Legislation*, ch. 1 (1789) published as Bentham, J. 1988. *The Principles of Morals and Legislation*. Amherst: Prometheus Books.

Bibas, S. 2004. Plea bargaining outside the shadow of the trial. *Harvard Law Review*, 117, 2464-2547.

Black, H. C. 1990. *Black's Law Dictionary*, West Publishing Company, St. Paul, Minnesota.

Byrne, Z. S., and Cropanzano, R. 2001. The history of organizational justice: The founders speak. In R. Cropanzano (Ed.), *Justice in the workplace: From theory to practice (Vol. 2)*:.Mahwah, NJ: Lawrence Erlbaum Associates. Inc:3-26.

Cooter, R., Marks, S. and Mnookin, R. 1982. Bargaining in the shadow of the law: a testable model of strategic behavior. *The Journal of Legal Studies*, 11(2): 225-251.

Fisher, R. and Ury, W. 1981. *Getting to YES: Negotiating Agreement Without Giving In*, Boston: Haughton Mifflin.

Fletcher, G. 1996. *Basic Concepts of Legal Thought*. Oxford University Press, New York

Folberg, J. and Taylor, A. 1984, *Mediation: a comprehensive guide to resolving conflicts without litigation*, Jossey-Bass social and behavioral science series, Jossey-Bass, San Francisco.

Foxall, G. 2004. WHAT JUDGES MAXIMIZE: TOWARDS AN ECONOMIC PSYCHOLOGY OF THE JUDICIAL UTILITY FUNCTION. *Liverpool Law Review* 25: 177-194.

Gazal-Ayal, O. 2006. Partial Ban on Plea Bargains, *Cardozo Law Review*, 27:2295-2349.

Gray, P., Gray, X. and Zeleznikow, J. 2007. Decision Negotiating Logic: For richer or poorer. To appear in the Proceedings of *Eleventh International Conference on Artificial Intelligence and Law*, ACM Press, Palo Alto, Ca., USA.

Hall, M. J. J., Calabro, D., Sourdin, T., Stranieri, A. and Zeleznikow, J. 2005. Supporting discretionary decision making with information technology: a case study in the criminal sentencing jurisdiction. *University of Ottawa Law and Technology Journal*. 2(1): 1-36

Hall, M. J. J., Hall, R. and Zeleznikow, J. 2003. A method for evaluating legal knowledge-based systems based upon the Context Criteria Contingency-guidelines framework. Proceedings of the *Ninth International Conference on Artificial Intelligence and Law*, Edinburgh, Scotland: ACM Press, 274-283.

Jouini, E., Schachermayer, W. and Touzi, N. 2005. *Optimal risk sharing for law invariant monetary utility functions*, http://www.crest.fr/pageperso/touzi/jst05a.pdf last accessed 6 April 2007.

Kahneman, D. and Tversky, A. 1979. Prospect theory: An analysis of decisions under risk. *Econometrica*, 47: 313-327.

Kahneman, D, Wakker,P. and Sarin, R. 1997 Back to Bentham? Explorations of experienced utility. *Quarterly Journal of Economics*, 12(2): 375.

Kennedy, G., McMillan, J. and Benson, J. 1984, *Managing negotiations*, 2nd ed. edn, Hutchinson Business, London

Kersten, G.E. 2001. Modeling Distributive and Integrative Negotiations. Review and Revised Characterization. Group Decision and Negotiation. 10(6):493-514.

Lax, D. A. and Sebenius, J. 1986. *The Manager as Negotiator*. New York, The Free Press.

Lodder, A. R. and Zeleznikow, J. 2005. Developing an Online Dispute Resolution Environment: Dialogue Tools and Negotiation Systems in a Three Step Model, The *Harvard Negotiation Law Review*, 10:287-338.

Mnookin, R., Peppet, S. R. and Tulumello, A. S. 2000. *Beyond Winning: Negotiating to Create Value in Deals and Disputes*, The Belnap Press of Harvard University Press.

Mnookin, R. H. and Kornhauser, L.1979, Bargaining in the shadow of the law: The case of divorce. *Yale Law Journal* 88: 950-997.

Nash, J.F. 1950. The Bargaining Problem, *Econometrica*, 18: 155–162

von Neumann, J. and Morgenstern, O. 1944. *The theory of games and economic behaviour*. Princeton: Princeton University Press.

Posner, R A. 1973. An Economic Approach to Legal Procedure and Judicial Administration, *Journal of Legal Studies*, 2: 399-458.

Posner, R A. 1993. What do Judges and Justices Maximize, *Supreme Court Ecoomic Review*, 3: 1-41.

Posner, R. A., 1995. *Economic Analysis of Law*, Aspen Law & Business, New York, NY.

Posner, R. A., 1998. *OVERCOMING LAW*, Harvard University Press

Pratt, J.W., Raiffa, H., Schlaifer, R., 1964. The foundations of decision under uncertainty: an elementary exposition. *Journal of the American Statistical Association*, 59: 353–375.

Pruitt, D.G, 1981 *NEGOTIATION BEHAVIOR*, New York, NY: Academic Press

Raiffa, H., 1968. *Decision Analysis: Introductory Lectures on Choices under Uncertainty*. Addison-Wesley, Reading, MA.

Raiffa, H. 1982. *The Art and Science of Negotiation: How to Resolve Conflicts and Get the Best Out of Bargaining*,Cambridge, Massachusetts: The Belknap Press.

Raiffa, H., Richardson, J. and Metcalfe, D. 2002. *Negotiation Analysis: The Science and Art of Collaborative* Sander, F. 1976, Varieties of dispute processing. *Federal Rules Decisions*, 70: 111.

Rawls, J. 1971. *A Theory of Justice*. The Belknap Press of Harvard University Press,. Cambridge, MA

Ross, H. 1980 *Settled Out of Court*, Aldine.

Saaty, T. 1980. *The Analytical Hierarchy Process: Planning, Priority, Allocation.*, Mac-Graw Hill, New York.

Stranieri, A, Zeleznikow, J, Gawler, M, & Lewis, B, 1999. A Hybrid rule- neural approach for the automation of legal reasoning in the discretionary domain of family law in Australia. *Artificial Intelligence and Law*, 7 (2-3): 153-183

Sycara, K. 1993. Machine Learning for Intelligent Support of Conflict Resolution, *Decision Support Systems*, 10:121-136.

Thiessen, E. M. and McMahon, J. P. 2000. Beyond Win-Win in Cyberspace. *Ohio State Journal on Dispute Resolution*, 15: 643.

Toulmin, S. E., 1958. *The Uses of Argument*, Cambridge University Press, Cambridge, UK

Van Velthoven, B. C. J.and Ter Voert, M .J. 2004, *Geschilbeslechtingsdelta 2003* The Hague: WODC/Boom.

Walton, R. E. and Mckersie, R. B 1965. *A Behavioral Theory of Labor Negotiations*, McGraw - Hill, New York.

Williams, G 1983 *Legal Negotiation and Settlement*, West Publishing Co., St. Paul, Minnesota.

von Wright, G. H. 1972. The logic of preference reconsidered. *Theory and Decision*, 3(2): 140-169.

Wright, R. W. 1999. PRINCIPLED ADJUDICATION: TORT LAW AND BEYOND *Canterbury Law Review* 7:265-296.

Zeleznikow, J. and Bellucci, E. 2003. Family_Winner: integrating game theory and heuristics to provide negotiation support. *Proceedings of Sixteenth International Conference on Legal Knowledge Based System.* IOS Publications, Amsterdam, Netherlands: 21-30.

Zeleznikow, J. and Bellucci, E. 2006. Family_Mediator - adding notions of fairness to those of interests. *Proceedings of Nineteenth International Conference on Legal Knowledge Based System.* IOS Publications, Amsterdam, Netherlands.

Zeleznikow, J., Bellucci, E., Vincent, A. and Mackenzie, G., 2007. Bargaining in the shadow of a trial: adding notions of fairness to interest-based negotiation in legal domains, to appear in the Proceedings of *Group Decision and Negotiation Meeting*, Mt. Tremblant (Montreal), Canada.

Zeleznikow, J. and Vincent, A. 2007. Providing Decision Support for Negotiation: the need for adding notions of fairness to those of interests. To appear in *University of Toledo Law Review*.