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Bargaining in the shadow of a trial: adding notions of fairness to interest-based negotiation in legal domains

John Zelzenikow¹, Emilia Bellucci¹, Andrew Vincent¹², Geraldine Mackenzie³

¹ School of Information Systems, Victoria University, Melbourne, Australia
John.Zeleznikow@vu.edu.au
Emilia.Bellucci@vu.edu.au
Andrew.Vincent1@research.vu.edu.au

² School of Historical and European Studies, La Trobe University, Melbourne, Australia
a.vincent@latrobe.edu.au

³ Law School, Queensland University of Technology, Brisbane, Australia
g.mackenzie@qut.edu.au

Abstract. Most negotiation support systems have focused upon the notion of meeting the disputants' interests. However in the legal domain, Alternative Dispute Resolution often occurs in the shadow of the law. Integrative bargaining neglects the vital issues of justice and power. In this article we address the issue of how to add notions of fairness to interests, through the development of the Family_Mediator system. Family_Mediator is an extension of the Family_Winner system, which advises mediators about potential trade-offs and compensation strategies for divorcing couples.

Keywords: Fairness; Interest Based Negotiation; Bargaining in the Shadow of the Law; Justice; Trade-Offs; Family Mediation; Plea-Bargaining.

1 Introduction

There has been a global movement towards encouraging disputants to resolve conflicts without the need for litigation. The development of negotiation support systems has supported this trend (Lodder and Zelzenikow 2005). Commentators have questioned whether such developments have always taken into account notions of justice and fairness (Alexander, 1997; Raines and Conley Tyler, 2007). In particular, has this trend led to certain parties being unjustly treated?

For example, are accused persons disadvantaged in guilty plea negotiations because of a lack of available information on sentencing precedents? Are some parties before the Family Court accepting outcomes which are unjust to both themselves and/or their children? In addition to the standard problems associated with the use of decision support systems (such as usability), how can we ensure
that the advice tendered by negotiation support systems is ‘reasonable’, ‘consistent’ and ‘based upon publicly acceptable principles’?

Traditional Negotiation Support Systems have focused upon providing users with decision support on how they might best obtain their goals. They are often based on Nash’s principles of optimal negotiation or bargaining (Nash 1953). The aim is to develop a win-win scenario. Such situations are described in (Raiffa, 1982), AdjustedWinner (Brams and Taylor 1996) and Family_Winner (Bellucci and Zeleznikow 2006).

(Fisher and Ury 1981) distinguish three modes of negotiation:

1. Interest based negotiation;
2. Justice based negotiation; and

Whilst many negotiations involve two or all three modes, most negotiation decision support has focused upon interest based or integrative negotiation. This is quite natural in areas such as online auctions (for example the operations of E-Bay) or e-commerce, where logical consumers will only engage in actions that are beneficial (in terms of their utility function). But in other domains, particularly regarding legal disputes, issues of power and justice must be taken into account.

For example, the concept of power in international disputes is a vital one. Despite the existence of the United Nations and the International Court of Justice; in times of conflict, smaller countries often need to abide by the desires of economically and militarily stronger countries. In a legal dispute between a consumer and large multinational company, it is usually the case that only the company has the financial resources to undertake a long and drawn out process of litigation and conflict.

Whilst the issue of power in negotiations is an important one, we shall not investigate it in this article. Rather, we shall focus upon how we can integrate notions of fairness or justice into an interest-based negotiation support system. We shall illustrate our ideas in the domain of Australian Family Law mediation, and also briefly discuss an application in the domain of plea-bargaining about sentences for criminal activities. In both domains, negotiations over outcomes invariably involve bargaining in the shadow of a trial.

2 BATNAs

Given our goal is to provide tools to support negotiation in the shadow of a trial, we need to examine the notions of BATNAs.

2.1 The Notion of a BATNA

Fisher and Ury (1981) introduced the notion of a BATNA (Best Alternative To a Negotiated Agreement) concept as a tool for negotiators to cope with power imbalances, e.g. one party may have a stronger bargaining position, or more (financial) resources than her opponent. 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. This may include exiting the procedure altogether, or handing over the case to a court. Once the alternatives are known, these can be compared to what one expects to win by accepting an offer in the current procedure. If the proposal is worse than the (best) alternative outside the procedure, it should be rejected; if it is better it should be considered for acceptance. In this respect each party's BATNA serves as a point of reference or a value with which to compare offers (Raiffa et al. 2002, p. 112).

The second reason why knowing one’s BATNA is important, is that it influences negotiation power. Parties who are aware of their alternatives will be more confident about trying to negotiate a solution that better serves their interests (de Vries et al 2005). When trying to sell one's car to a second hand car dealer, knowing what other car salesmen (or even individuals) offer or have offered for your (or a similar) car, helps in obtaining a reasonable price for your vehicle.
BATNAs not only serve a purpose in evaluating offers in the dispute, they can also play a role in determining whether or not to accept a certain dispute resolution method. Mnookin (2003) wrote that having an accurate BATNA is part of the armory one should use to evaluate whether or not to agree to enter a negotiation.

In their development of a three step model for Online Dispute Resolution, (Lodder and Zeleznikow 2005) evaluated the order 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. We will next discuss how we have developed BATNAs in Australian family law. A brief description of our work on developing BATNAs in sentencing is given in section 5. Extended details can be found in (Hall et al 2005).

Lodder and Zeleznikow’s model, in suggesting providing advice about BATNAs, facilitating dialogue and suggesting trade-offs, focuses upon E-Commerce applications. Their research assumes that disputants focus upon interests. As we shall see, there are many legal disputes in which notions of fairness or justice must be considered.

Calculating one’s BATNA is an important step in the decision whether to go to court or to mediate. Ideally, such a decision is based on a well-informed choice, although unfortunately, the information necessary to make such a decision is often lacking. It is important to provide litigants with information about the expected outcome of court proceedings. For example, data mining techniques\(^1\) or semantic web technology\(^2\) can be used to determine a BATNA.

At the moment, there is no generic tool available for determining BATNAs. As an example of how machine learning may be used to help determine one’s BATNA, we will describe a software tool currently used in the Australian family law arena, Split-Up (Stranieri et al 1999).

### 2.2 The Split-Up system: providing BATNAS for property distribution in Australian Family Law

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. The following example, taken from (Bellucci and Zeleznikow 2001), illustrates this point.

Suppose the disputants' goals are entered into the Split-Up system to determine the asset distributions for both W and H. Split-Up first shows both W and H what they would be expected to be awarded by a court if their relative claims were accepted. The litigants are able to have dialogues with the Split-Up system about hypothetical situations. Given the requirements of W and H in a

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1 See (Stranieri and Zeleznikow 2004) and section 2.3.
2 For a discussion of the use of semantic web technology to help develop BATNAs in the domain of Dutch Liability Law, see (Klein et al 2006).
hypothesised example, the Split—Up system provided the following answers as to the percentages of the distributable assets received by each partner:

<table>
<thead>
<tr>
<th>Resolution</th>
<th>H’s %</th>
<th>W’s %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Given one accepts W’s beliefs</td>
<td>35</td>
<td>65</td>
</tr>
<tr>
<td>Given one accepts H’s beliefs</td>
<td>58</td>
<td>42</td>
</tr>
<tr>
<td>Given one accepts H’s beliefs but gives W custody of children</td>
<td>40</td>
<td>60</td>
</tr>
</tbody>
</table>

Clearly, custody of the children is very significant in determining the husband’s property distribution. If he were unlikely to win custody of the children, the husband would be well advised to accept 40 percent of the common pool (otherwise he would also risk paying large legal fees and having ongoing conflict).

While Split-Up is a decision support system rather than a negotiation support system, it does provide disputants with their respective BATNAs and hence provides an important starting point for negotiations. However, more than a BATNA calculation is required of negotiation support systems. Namely, a negotiation support system should model the structure of an argument, provide advice on how to sequence the negotiation, and propose solutions.

The use of BATNAS and trade-offs, assumes all parties are involved in interest-based or integrative negotiations. Such negotiations focus on developing mutually beneficial agreements based on the interests of the disputants. However there are some scenarios where the concept of justice based negotiation must take precedence over integrative negotiation.

### 3 Integrative Negotiation

Walton and Mekersie (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). Game theory has been used as the basis for the Adjusted Winner algorithm (Brams and Taylor 1996) and the negotiation support systems: Smartsettle (Thiessen and McMahon 2000) and Family Winner (Bellucci and Zeleznikow 2006).

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3 For example, in Australian Family, the interests of the children are paramount. So a Family Law judge can override a negotiated settlement between the parents if she does not believe the agreement meets the need of the children. This issue is discussed in section 3.4 an in further detail in Bellucci and Zeleznikow (2006).
3.1 Bargaining in the Shadow of the Law

Whilst the concept of negotiation has a long history, the modern Alternative Dispute Resolution movement in the law can be traced back to Sander (1976).

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.

(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. Mnookin and Kornhauser (1979) introduced the shadow of 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.

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 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.

3.2 Using Game Theory to support Integrative Bargaining

The Adjusted Winner point-allocation model {(Brams and Taylor 1996) and (Brams and Taylor 1999)} is a procedure whereby items/issues are allocated to the disputants on the basis of whoever values the item/issue more. The disputants are required to indicate explicitly how much they value each of the different issues by distributing 100 points across the range of issues in dispute. The Adjusted Winner paradigm is a fair and equitable procedure because at the end of allocation, each party will have accrued the same number of points.

If, as is generally the case, the disputants do not have directly opposing goals, it is likely that each disputant will receive more than fifty points. This is thus an improvement on any strategy that is based on the zero-sum game philosophy – where each party wins what the other loses. Where giving an issue/item to one party will lead to an inequality of points among the disputants, a form of proportional representation is used for the final issue in dispute. The final proposed solution might involve sharing some issues (such as selling a piece of property and distributing the money received from it or sharing custody of the children) to ensure that each of the disputants receives an equal number of points for the issues in dispute.
(Zeleznikow et al 2002) have previously used the multi-criteria decision-making approach. The most typical such approach requires the user to directly assign values to each alternative for a given criterion. After setting forth the issues, the disputants must decompose such issues into sub-issues until their positions are reflected in the sub-issues. Each issue is broken down so that allocation issues are binary in form: each issue is allocated to either the Husband or the Wife. Their Family_Winner system uses a theory of pair-wise comparisons to determine whether the Husband or Wife is allocated an item or an issue. Upon reaching the lowest level in the hierarchy (as specified by the disputants), the system mathematically calculates the value of each sub-issue or item with respect to the relative super-issues or items. It does so for each party. Once completed, the system calculates which party is allocated particular sub-issues or items through pair-wise comparisons over the derived values from both parties (Bellucci and Zeleznikow 2001).

(Sycara 1998) argues that one should assume bounded rationality and the presence of incomplete information in developing real-world negotiation support systems. Our model of legal negotiation assumes that all actors behave rationally. The model is predicated on economic bases, that is, it assumes that the protagonists act in their own economic best interests. While much human negotiation is not necessarily based upon rational economic behavior, we believe the goal of negotiation support systems should be to provide rational advice. Hence, the environment that we are developing therefore assumes the existence of rational actors.

(Bellucci and Zeleznikow 2006) wished to integrate artificial intelligence and game theory techniques to develop intelligent negotiation support systems. Given their previous research on developing negotiation support systems in Australian family law, they decided to develop systems in that domain. They saw that an important way in which family mediators encouraged disputants to resolve their conflicts was 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. From efforts to build negotiation support systems, they noted that while it appears counterintuitive:

1. The more issues and sub-issues in dispute, the easier it is to form trade-offs and hence reach a negotiated agreement; and
2. 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.

Family_Winner (Bellucci and Zeleznikow 2006) uses both game theory and heuristics. In assisting the resolution of a dispute, Family_Winner 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.4

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

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4 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).
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 triggering been empirically determined from an analysis of data. The input consists of:

1. **Issues in dispute.** Both disputants are requested to enter the issues in dispute
2. **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.
3. **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.
4. 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:
   5. **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.
6. **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 detail in (Bellucci and Zeleznikow 2006)) to store all issues (and sub-issues) and makes use of Trade-off Maps to deliver a compensation strategy. The output consists of a list of allocations, which form the basis of the advice provided by the system.

In the next section we give an algorithmic description of how Family_Winner operates.

### 3.3 A formalism for developing Family_Winner’s trade-offs

#### 3.3.1 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 \( x_D = \{x_{D_1}, x_{D_2}, \ldots, x_{D_k}\} \) and \( y_D = \{y_{D_1}, y_{D_2}, \ldots, y_{D_k}\} \) respectively.

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

\[
\text{NEW}(x_{D_i}) = \frac{(x_{D_i} \times 100)}{\sum x_{D_i}} \quad \text{and} \quad \text{NEW}(y_{D_i}) = \frac{(y_{D_i} \times 100)}{\sum y_{D_i}} \quad \text{where} \quad i \in \{1, 2, \ldots, k\}
\]

[1]
Each issue can be decomposed into sub-issues $D_i = \{D_{i,1}, \ldots, D_{i,g(i)}\}$, 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 $\sum x_{Di,j} = 100$; and $\{y_{Di,1}, \ldots, y_{Di,g(i)}\}$ where $\sum y_{Di,j} = 100$; then the p-rating for $X_{di,j}$ is $x_{di} * x_{di,j} / 100$ and the p-rating for $Y_{di,j}$ is $y_{di} * y_{di,j} / 100$.

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 issue1 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).

### 3.3.2 Choosing the order of allocation

The order in which issues are considered for decomposition or allocation is then calculated. Specifically, the function in [2], choose(i) calculates the numerical difference between the ratings set by both parties towards the same issues.

Let set $D^\top = \{d_1, d_2, \ldots, d_k\}$ be the set of differences between the ratings of the issues in dispute, where $d_i = |x_{Di} - y_{Di}|$ with $i \in \{1, 2, \ldots, k\}$. 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.

A brief discussion of revised ratings will be conducted in 3.3.4. These 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 issue 3 with a value of 0. Party W has issue1 with a value of 50, issue2 with a value of 30 and issue 3 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 issue 3 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.

### 3.3.3 Allocating Issues

Compromising is a hybrid approach of the above four. It is used to describe behaviours that are both moderate in assertiveness and cooperativeness. In the process of conflict resolution, the objective is to find a mutually acceptable solution for both parties.

As a result, some degree of concession has to be made by all the parties involved. From the definition, it is an approach between competing and accommodating; similarly, it is also lies in the middle of avoiding and collaborating.

### 3.3.4 Third level heading

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 issue 3. H needs to be compensated because W is awarded 3.
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 $GAIN(W,1) = 20$.

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 $i \in \{1, 2, ..., k\}$ [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 combined to form a series of graphs, used to extract the amount of change affecting ratings.

### 3.3.5 Performing Trade-Offs

Once 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 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. There is no claim that the functions are in any way optimal.

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.

Data analysis of six hundred cases provided by the Australian Institute of Family Studies, revealed several heuristics relevant to our investigation on the development of Family_Winner’s allocation strategy. For example, if the issue lost is very important, and the strength of relationship is very significant, then the values of the relevant issue will increase. If a very important issue is allocated to a party, and the strength of relationships are very significant, then the ratings of relevant issues will not change. A relationship is considered very significant if the relationship factor is high.

Results from the above-mentioned analysis were used to form a series of ten graphs, as described in (Bellucci, 2004). Each graph illustrates the change to issues following an issue’s allocation. Each graph symbolises a different scenario based on whether the issue was gained or lost, and the importance exhibited by the rating of the allocated issue. Graphs are consulted to determine the appropriate level of compensation awarded following an allocation. Specifically, graphs provide the percentage change to be applied (Y-axis) given the level of discourse surrounding an issue (X-axis).
Values on the X-axis represent the difference between the ratings of each issue, calculated according to equations [4] and [5]. The range of the X-axis is from 0–100, where 0 indicates issues of minimal argument, and 100 indicating a greater level of discourse exhibited by the issue. The Y-Axis indicates the amount of change resulting from an allocation. It has values ranging from -100 to 100, to indicate the most negative change to the most positive change applied to the value of a rating.

To illustrate how Family_Winner uses these graphs, suppose party H lost Issue1, assigned a rating of 70. Since Issue1 is valued Very Important (according to a linguistic assignment to ratings, given in Table 1), then a graph GraphLost4 (Figure 2) is consulted to retrieve compensation figures. Assume the following issues exist, where Issue2 exhibits a rating of 20, and Issue3 is valued by 10. The relationship factors are in the amounts of 50 (for trade-off between Issue 1 and issue 2) and 60 (for trade-off between Issue 1 and Issue 3). These numbers, corresponding to X-axis values, are then applied to the graph. The corresponding Y-axis recommended 75% change to Issue 2 and 50% change to Issue 3.

Table 1. Linguistic importance assignments to rating ranges

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<thead>
<tr>
<th>Rating range</th>
<th>Linguistic Importance assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;= 10</td>
<td>Not Important</td>
</tr>
<tr>
<td>11 to 20</td>
<td>Moderately Important</td>
</tr>
<tr>
<td>21 to 35</td>
<td>Important</td>
</tr>
<tr>
<td>36 to 55</td>
<td>Quite Important</td>
</tr>
<tr>
<td>&gt; 55</td>
<td>Very Important</td>
</tr>
</tbody>
</table>

We have included one graph, GraphLose4 as Figure 1, to give the reader a sample of the graphs. There are in total ten diagrams, each one representing the compensation levels for every category (determined by the value of the issue), and whether it is lost or gained. The remaining graphs can be found in (Bellucci, 2004) at p108-117.

Figure 1. GraphLose4: a sample taken from graphs used in the calculation of compensation figures
The amount of compensation awarded is calculated by graphs that were derived from data obtained from domain experts. The example graph in Figure 1 indicates the level of compensation, to be awarded based on the value of ratings, the strength of the trade-off relationship and whether the issue has been lost or gained by a disputant. Whilst it is obvious why a party losing an issue should be compensated, it is equally important to reward a party for being allocated an issue that she did not value importantly.

The manner in which compensation is awarded is dependent upon the value of a percentage change, applied to relevant ratings. Once the percentage change of all affected issues has been derived (from the graph functions), the values of new ratings are calculated. To form new ratings, the percentage change relevant to an issue is retrieved and incorporated according to the following equation:

\[ D \text{ is the union of the issues that have been raised by the disputants. } C_j \text{ is the union of all issues connected to an allocated issue, } j. \text{ For each } d_i \in D, \text{ a set } X \text{ is defined as the numerical rating calculated on behalf of a party, to each of the issues in } D. \text{ For each } c_i \in C, \text{ a set } Y \text{ is defined as the percentage of change, obtained from relevant graph function } f. \text{ Thus } X = \{x_1, x_2, \ldots, x_k\} \text{ and } Y = \{f(x_1), f(x_2), \ldots, f(x_k)\}. \]

\[ x_{D_i} = x_i + x_i \times f(x_i) / 100 \text{ where } i \in \{1, 2, \ldots, k\} \text{ and } f \text{ is determined empirically. } \]  

Subsequent to allocation, the ratings of remaining issues may be modified due to compensation, to influence issue allocation in the following rounds of allocation.

These new ratings \( x_{D_i} \) replace existing rating values \( x_i \). \( x_{D_i} \) values are then used to decide the outcome of the next round of allocation. The program then displays a summary report to notify disputants on the current status of the negotiation. The summary page displays the issues and parties to which the issues are allocated, both diagrammatically through the Issue Decomposition Hierarchy, and by generating a complete list of issues. Both the old and new values of ratings, as a result of the recent allocation, are listed.

The process of allocation and issue decomposition continues until there are no more issues to allocate, at which point the program ceases execution.

It is important to note that the formulas mentioned in this section (equations [1-6]) were derived from our observation of data analysis, as opposed to representing proven mathematical formulae. We believe negotiation is an art and not a science. In addition, negotiation is characterised by changing ratings, which makes it difficult to arrive at a theoretical function. We argue a theoretical function cannot exist, otherwise there would always be a perfect solution for each negotiation. (Bellucci 2004) discusses in great depth the validity of the formulae through an analysis of case studies and in the formal evaluation of the Family_Winner system.

3.4 The operation of Family_Winner on a hypothetical case

The following example is taken directly from (Bellucci and Zeleznikow 2006). It gives an excellent insight into the manner in which Family_Winner operates.

Suppose Cassandra (Wife) and Paul (Husband) Jones have been married for fifteen years and have two sons aged thirteen and eleven. Cassandra wants a divorce and an immediate property settlement. She also believes that although she received income from employment, throughout her marriage, her principal role was as a homemaker and a nurturer.

Both agree to the distribution of the joint marital property consisting of a house, his Mitsubishi car, and her Holden car. In addition, she believes she is entitled to a portion of her Husband’s share portfolio and of his superannuation (or pension) entitlements. Cassandra wishes to retain the house

---

5 This scenario is highly unlikely to occur as the systems’ primary focus is to allocate issues to parties who value them the most.
and the Holden car, while Paul wishes to retain his Mitsubishi car and agrees to an equal share distribution of both the share portfolio and his superannuation entitlements.

Cassandra believes she should receive primary residency of the children. She consults a lawyer who advises her that given what Cassandra has told the lawyer, as the parent with current primary residency of the children, she should seek 60% of the marital property and adequate child allowance (this is in effect her BATNA). The 60% of the marital property that she desires mainly consists of the matrimonial home and the holiday house. She wishes to retain both of these properties.

When Paul receives a letter of claims from Cassandra’s lawyer, he approaches a lawyer, who provides advice on developing an appropriate BATNA.

The case is presented to the Family_Winner system, using the following data as input.

Table 2. Initial input of Issues and ratings for use in the hypothetical Family Law Negotiation.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Husband’s ratings</th>
<th>Wife’s ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child-related issues</td>
<td>70</td>
<td>50</td>
</tr>
<tr>
<td>Property Issues</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>Monetary Issues</td>
<td>10</td>
<td>35</td>
</tr>
</tbody>
</table>

This information is then analysed by a number of functions. These functions include the translation of data into Trade-off Maps, the relaying of information to the database, forming issue allocations and modifying the ratings of the issues in the negotiation to reflect allocations.

Once the user has entered the data appropriately, the next screen displays Trade-off Maps generated by the system. Figures 2 and 3 are the Trade-off Maps displayed to disputants following the input of the issues listed in Table 2.

Figure 2. The Husband’s Trade-off Map after the initial input of the primary issues

Figure 3. The Wife’s Trade-off Map after the initial input of the primary issues.

The disputants are asked to decompose an issue into many smaller sub-issues. Sub-issues are then incorporated into the dispute through the formation of an Issue Decomposition Hierarchy.

Child-related Issues is the first issue to be considered for decomposition or allocation. Table 3 lists the point allocations (ratings) given to each issue by the Husband and the Wife, and the ratings used in the dispute (p-ratings), which represent the influence of Child-Related Issues on the sub-
issue’s initial point allocation. P-ratings are calculated as a ratio of the parent issue’s rating. For instance, Party A gives issue1 a rating of 60, and issue2 a rating of 40. Issue11 has a p-rating of 10 (10% of 60) = 6, and Issue12 a p-rating of 90 (90% of 60) = 54.

Table 3. Ratings and p-ratings for the sub-issues of Child-Related Issues.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Husband’s ratings</th>
<th>Wife’s ratings and p-ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residency</td>
<td>25</td>
<td>17.5</td>
</tr>
<tr>
<td>Visitation Rights</td>
<td>50</td>
<td>35</td>
</tr>
<tr>
<td>Child support</td>
<td>25</td>
<td>17.5</td>
</tr>
</tbody>
</table>

The Trade-off Map is now altered to include the sub-issues of the primary issues. The modified Trade-off Maps of both parties are detailed in Figures 4 and 5.

Family_Winner allocates a parent issue through the allocation of its sub-issues. Therefore, in this example, one of the issues listed in Table 2 will be allocated next. All the sub-issues of Child-related Issues will be allocated before the negotiation moves to consider other issues.

The system allocates an issue to one of the parties. The party whose rating is greatest for the issue is allocated the issue. If both disputants value the issue equally, then the next issue to be allocated replaces the issue in question. The rating of issues connected to the issue just allocated is revised, based on empirically derived mathematical functions. The allocation of an issue involves removal of the issue from the Trade-off Maps, and making appropriate changes to the ratings of affected issues.
The first issue in this example to be allocated is *Visitation Rights*. It is awarded to the Husband, as his rating of 35 is greater than the Wife’s equivalent of 5. As a result of the Husband’s allocation, the ratings of remaining issues are changed. The following table lists all existing issues, their updated ratings and the percentage change resulting from the allocation of *Visitation Rights* to the Husband.

Table 4. Changes made to the ratings of issues following the allocation of Visitation Rights to the Husband.

<table>
<thead>
<tr>
<th>Issue Name</th>
<th>Husband’s ratings</th>
<th>Wife’s ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child support</td>
<td>18.375 (5 % change)</td>
<td>15 (0 % change)</td>
</tr>
<tr>
<td>Residency</td>
<td>18.375 (5 % change)</td>
<td>41.25 (37.5 % change)</td>
</tr>
<tr>
<td>Monetary Issues</td>
<td>10.5 (5 % change)</td>
<td>52.5 (50 % change)</td>
</tr>
<tr>
<td>Property Issues</td>
<td>21 (5 % change)</td>
<td>15 (0 % change)</td>
</tr>
</tbody>
</table>

As a result of the Husband’s allocation of an issue he considered important (valued at 35 points), his ratings did not change considerably. The Wife was duly compensated for her loss of *Visitation Rights*, valued relatively unimportant at 5 points.

The relative Trade-off Maps of each party, shown in Figures 6 and 7, can be interpreted to explain the amount of change each rating experienced as a result of the allocation. The Husband’s ratings experienced little change as the issue’s rating was considered by the system to be of great importance to the Husband. All ratings experienced an increase of 5%, as the relationship figures between the issues and *Visitation Rights* were all similar in number. Their relationship figures were 17 between *Child Support*, 17 between *Residency*, 25 between *Monetary Issues* and 15 between *Property*.

The Wife was compensated for her loss of *Visitation Rights* (valued at 5 points), through those issues whose relationship with Visitation Rights is of relatively greater significance. The trade-offs between *Visitation Rights* and *Monetary Issues*, and *Visitation Rights* and *Residency* held relationship values of 30 and 25 respectively. These issues were the only ones whose ratings increased, with increases of 50% and 37.5% respectively. *Property Issues* and *Residency* did not change their ratings, as their relationships with *Visitation Rights* were valued at 10 points each.

Trade-off maps display the trade-offs currently applicable to the dispute. Once an issue is removed from a dispute through allocation, the Trade-off Map is modified to reflect this change. The issue is removed from the map, and the ratings of the remaining issues are re-calculated according to the values dictated by the applicable trade-off relationships.

The resulting Trade-off Maps following the allocation of *Visitation Rights* are demonstrated in Figures 6 and 7.

Figure 6. Husband’s Trade off Map after the allocation of Visitation Rights.
Figure 7. Wife’s Trade-off Map after the allocation of Visitation Rights.

The system continues to traverse the hierarchy, by either allocating or decomposing issues, until all issues have been allocated. A summary of subsequent allocations is found in Table 5.

Table 5. Allocation table for the hypothetical Family Law Dispute.

<table>
<thead>
<tr>
<th>Husband’s allocations</th>
<th>Wife’s allocations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visitation Rights</td>
<td>Residency</td>
</tr>
<tr>
<td>Shares</td>
<td>Superannuation</td>
</tr>
<tr>
<td>Child Support</td>
<td>Matrimonial Home</td>
</tr>
<tr>
<td>Investment Unit</td>
<td>Holiday House</td>
</tr>
<tr>
<td>Mitsubishi Car</td>
<td>Holden Car</td>
</tr>
<tr>
<td>Boat</td>
<td></td>
</tr>
</tbody>
</table>

3.5 The need for Justice Based Negotiation

Traditional Negotiation Support Systems have focused upon providing users with decision support on how they might best achieve their goals (Raiffa, 1982). A fundamental issue arises whenever anyone builds a negotiation support system for use in legal domains: is the system being developed concerned with supporting mediation or providing justice? When issues of justice are not reflected in the outcome of the mediation process, bargaining theory has its limitations.

In December 2002, we met with a number of family law solicitors at Victoria Legal Aid to evaluate the performance of the Family_Winner system. Whilst the solicitors were very impressed with how Family_Winner suggested trade-offs and compromises, they had one major concern – that Family_Winner in focusing upon mediation had ignored issues of justice.

(Alexander 1992) has illustrated that women tend to be more reluctant than men to continue conflict and are more likely to wave their legal rights in a mediation session. If their major goal is to be the primary care giver for their children, they may reach a negotiated settlement, which whilst acceptable to them, is patently unjust. The wife may for example, give the husband the bulk of the property, in return for her being granted the primary care of the children. Whilst such an arrangement may meet the goals of both parents, it does not meet the paramount interests of the children, who will be deprived of subsequent financial resources. Family Law is one domain where interest-based
notions of mediation conflict with notions of justice. In such domains, the use of negotiation support systems that attempt to equally satisfy both parties is limited.\(^6\)

One lesson learned from the evaluation of family law disputes is that suggested compromises might conflict with law and justice. This problem can arise where a fully automated Online Dispute Resolution (ODR) environment is used in which resolution is based on consensus. Nevertheless, we believe that our ODR environment may still play a positive role in the family-law setting. One safeguard for use of ODR in fields such as family law may be required certification of the result by a legal professional.

4 Integrating interests with fairness

4.1 Consistency and Justice in Family Mediation and Plea Bargaining

Alexander (1997) has argued that in Australian Family Law, women tend to be more reluctant than men to continue conflict and are more likely to waive their legal rights in a mediation session. In discussing Australian Family Law, Bellucci and Zeleznikow (2006) claim that mediation may conflict with the notion of justice. McEwen et al (1995) believe family mediators focus upon procedural fairness rather than outcome fairness. Phegan (1995) argues that differences in power between men and women lead to negotiated results that favour men. Bargaining imbalances thus produce unfair results unless mediators can overcome them.

Although not always known as “plea bargaining”, guilty plea negotiations in Australia are commonplace, (Mack and Roach Anleu, 1996) although not necessarily openly used (Seifman and Freiberg, 2001). Plea bargaining is inherently useful to the criminal justice system, not just because of administrative efficiency; as it enables the accused, if properly advised, to negotiate concessions in the form of reduced charges or which facts are to be put before the court (Seifman and Freiberg, 2001). It is critical however that the accused has as certain as possible an indication of the sentence which will be imposed (Mack and Roach Anleu, 1995), and this is where the current system is lacking. At present, this is a major problem in justice and consistency for defendants, and one which this project addresses.

There are possible negative consequences of negotiating about pleas. Bibas (2004) argues that many plea bargains diverge from the shadow of trials. He claims that rather than basing sentences on the need for deterrence, retribution, incapacitation or rehabilitation, plea bargaining effectively bases sentences in part on wealth, sex, age, education, intelligence and confidence. Bibas suggest that while trials may allocate punishment imperfectly, plea bargaining adds another layer of distortions and warps the allocation of punishment.

Adelstein and Miceli (2001) develop a general model of plea bargaining, embed it in a larger framework that addresses the costs of adjudication, the value of punishing the guilty and the costs of false convictions, and then link the desirability of plea bargaining and compulsory prosecution to the weights given these costs and benefits in the objective function. 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. Tor et al (2006) conducted experiments in which they determined that defendants' willingness to accept a plea bargain is substantially reduced when defendants feel that the offer is unfair, either because they are not guilty or because other defendants received better offers. Wright and Miller (2003) believe that pervasive harm stems from charge bargains due to their special lack of

\(^6\) (Wade 2004) disagrees. He argues that is very rare for Family Court judges to over-ride the wishes of the parents.
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.

Following advice from both Victoria Legal Aid and Relationships Australia, (Bellucci and
Zeleznikow 2006) realised they needed to adapt the Family_Winner system to meet both parents’
interests and the paramount interests of the children. This research involves combining both interest-
based and justice-based notions of negotiation.

4.2 The Family_Mediator System – integrating notions of justice into the
Family_Winner system

The Family_Winner system was designed to help mediators encourage disputants to settle their
disputes through the use of trade-offs. The system focused upon trying to determine each of the
disputant’s interests and then uses game theory to suggest good solutions (not necessarily optimal).
But as indicated in section 3.5, Australian family law focuses upon the paramount interests of the
children, not upon the interests of the parents.

In late 2005, the Family_Winner system achieved much media attention, including over a dozen
radio interviews in all Australian states, on BBC Radio 5 and separately the BBC World Service,
articles in the Sydney Morning Herald7, the Times of London, the Australian Financial Review and
the Economist8. The inventors were asked to compete on ABC (Australian Broadcasting

As a result of this publicity, Professor Zeleznikow and Dr. Bellucci received much interest in
commercializing Family_Winner. One expression of interest came from the Queensland branch of
Relationships Australia. Relationships Australia is one of Australia’s largest community-based
organisations providing relationship support to people. It provides advice to couples that are
contemplating divorce. The Queensland Branch of Relationships Australia10 wants to use a modified
version of Family_Winner to provide decision support for their clients. The application domain is
counsels agreements about the distribution of marital property.

Instead of Family_Winner attempting to meet both parents’ interests to basically the same degree,
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 thus:
1. 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) %

November 29 2006.
November 29 2006.
2. The mediator decides on the value of each item in dispute.
3. Both the Husband and Wife give points to each of the items in dispute\textsuperscript{11}.
4. 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.

Initially we believed that the distribution of the Family Mediator system should suggest trade-offs and compensations so that the ratio of the wife’s points to the husband’s points is $X : (100 - X)$. As an example, in step a), the mediator would suggest the wife should receive 60% of the property. Then in d), rather than each party receiving 70 points, the wife receives 150% of 70 points, or 105 points and the Husband receives 66 2/3% of 70 points or 47 points. This algorithm may however lead to the husband rejecting the suggestion.

The revised algorithm, as described above, derives what may well be considered as a more acceptable suggestion: where the wife receives 110% of 70 points, or 77 points and the Husband receives 90% of 70 points or 63 points.

The development of Family Mediator allows the concept of interest-based negotiation as developed in Family Winner to be integrated with notions of justice. The advice about principles of justice can be provided by decision support systems that advise about BATNAs (e.g. Split_Up) or human mediators.

### 4.3 Extending the Family Mediator System

Unlike the Family Winner system, Family Mediator system allows users to input negative values\textsuperscript{12}. This development is necessary because family mediation clients often have debts (such as credit card debts and mortgages) which are as much items in the negotiation as assets.

Further, to ensure that Family Mediator proposes an acceptable solution, it might be necessary to include as a universal issue in all disputes, a cash variable payment item. For example, where the wife has identified that her highest preference is to retain the family home, an outcome might provide for her to keep the matrimonial home and the mortgage\textsuperscript{13}. In order to reach an acceptable settlement, the wife might need to make a cash payment to the husband. Hence we have stipulated the requirement that a variable appear in the output.

A further limitation of the Family Winner system (arising from its similarity to the AdjustedWinner algorithm) is the need for users to enter numerical values. Whilst disputants can probably linearly order\textsuperscript{14} the significance to them of all items in dispute, it is unrealistic to expect them to give a numerical value to each item. But it is not unreasonable for the users to assign a linguistic variable to each item. We suggest a seven point scale which can then be converted into points:

<table>
<thead>
<tr>
<th>Description</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrelevant</td>
<td>0</td>
</tr>
<tr>
<td>Little Significance</td>
<td>10</td>
</tr>
<tr>
<td>Marginal</td>
<td>20</td>
</tr>
<tr>
<td>Moderate</td>
<td>30</td>
</tr>
<tr>
<td>Important</td>
<td>40</td>
</tr>
<tr>
<td>Very Important</td>
<td>50</td>
</tr>
</tbody>
</table>

\textsuperscript{11} As in the entering of the points into the Family Winner system, the points are normalized to 100.

\textsuperscript{12} Thanks are due to Natasha Rae of Relationships Australia (Queensland) for this suggestion.

\textsuperscript{13} A negative item.

\textsuperscript{14} A set \{ $x_1, x_2, \ldots, x_n$ \} is linearly ordered if it is of the form $x_1 \leq x_2 \leq \ldots \leq x_n$. 

Suppose the parties enter the following terms for the issues in dispute in the example given in section 3.4.

<table>
<thead>
<tr>
<th>Item</th>
<th>H description and thus unscaled points</th>
<th>W description and thus unscaled points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residency</td>
<td>Little Significance 10</td>
<td>Essential 60</td>
</tr>
<tr>
<td>Visitation Rights</td>
<td>Very Important 50</td>
<td>Irrelevant 0</td>
</tr>
<tr>
<td>Shares</td>
<td>Important 40</td>
<td>Little Significance 10</td>
</tr>
<tr>
<td>Superannuation</td>
<td>Little Significance 10</td>
<td>Moderate 30</td>
</tr>
<tr>
<td>Child Support</td>
<td>Moderate 30</td>
<td>Irrelevant 0</td>
</tr>
<tr>
<td>Matrimonial Home</td>
<td>Irrelevant 0</td>
<td>Important 40</td>
</tr>
<tr>
<td>Investment Unit</td>
<td>Marginal 20</td>
<td>Irrelevant 0</td>
</tr>
<tr>
<td>Holiday House</td>
<td>Irrelevant 0</td>
<td>Marginal 20</td>
</tr>
<tr>
<td>Mitsubishi Car</td>
<td>Marginal 20</td>
<td>Irrelevant 0</td>
</tr>
<tr>
<td>Holden Car</td>
<td>Irrelevant 0</td>
<td>Moderate 30</td>
</tr>
<tr>
<td>Boat</td>
<td>Marginal 20</td>
<td>Irrelevant 0</td>
</tr>
</tbody>
</table>

The husband’s total score is 200. Thus to scale his scores each number is multiplied by 100/200 = 0.5. The wife’s total score is 190. Thus to scale her scores each number is multiplied by 100/190 = 0.53. This leads to a points table:

<table>
<thead>
<tr>
<th>Item</th>
<th>H Points</th>
<th>W Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residency</td>
<td>5</td>
<td>32</td>
</tr>
<tr>
<td>Visitation Rights</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>Shares</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>Superannuation</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>Child Support</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>Matrimonial Home</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Investment Unit</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Holiday House</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Mitsubishi Car</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Holden Car</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>Boat</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

These points are then utilised by the Family_Mediator algorithm.

## 5 Sentencing and Plea Bargaining

The use of Alternative Dispute Resolution in criminal law is fairly limited compared to its use in commercial law and family law. Perhaps its major use has been in the criminal domain has been in the area of restorative justice\(^{15}\) (Graef 2000).

\(^{15}\) Restorative justice is a theory of justice that emphasises repairing the harm caused or revealed by criminal behaviour. It is generally accomplished through cooperative processes that include all stakeholders, hence its possible classification as a form of Alternative Dispute Resolution. Some of the programs and outcomes typically identified with restorative justice include: victim offender mediation; conferencing; sentencing circles; victim assistance and the use of victim impact statements; restitution and community service.
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 defendant’s 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, over 90% of all criminal convictions come from guilty pleas (Colella 2004); with this figure rising to over 95% in the federal jurisdiction (Cook 2004). Most of these are secured through plea bargaining (Bar-Gill and Gazal Ayal 2006).

The fact that in most American States there are minimum sentences for the most common crimes, ensures that the prosecution is able to enter into a plea bargain where they usually have some control over the final sentence. Stuntz (2004) suggests that the success of the plea bargaining process depends on the prosecutor’s ability to make credible threats of severe post-trial sentences. Credible threats concerning sentence severity are enhanced in jurisdictions that have determinate sentencing regimes. Bibas (2004) has noted that some scholars treat plea-bargaining as simply another case of bargaining in the shadow of a trial. The shadow of trial concept was discussed by Mnookin and Kornhauser (1979). 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. Plea-bargaining in the United States, even though it has had the support of the Supreme Court for over thirty years\(^\text{16}\) has been heavily criticised because of the power of the prosecutor to engage in selective utilisation of the bargaining process. Bibas (2004) claims that trials in the United States already allocate punishment unfairly and that plea-bargaining adds another layer of distortion. Both Bibas and Stuntz have at the heart of their respective discussions the claim that the Mnookin-Kornhauser model is not really applicable to the plea bargaining process because of the great number of other influences on the actors/players in the plea-bargaining show/game than occurs in negotiations about divorce.

Vincent and Zeleznikow (2005) have been constructing a plea-bargaining decision support system for Victoria Legal Aid in the Victorian lower (Magistrates) courts. VLA handles 80% of criminal law defense cases in Victoria. It hence finds decision support systems that advise upon appropriate decisions for the sentencing of criminals, as well as systems that will help in the plea-bargaining process, very useful for training and providing support for novice lawyers.

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 use of a sentencing decision support system is only one method for providing a defendant with a BATNA. Lawyers could equally provide such advice. The plea-bargaining environment is not wholly reliant on an information system to provide a BATNA. The sentencing decision support system provides advice concerning possible sentences, but can also give information about how these sentences might be combined, either cumulatively or consecutively in the case of multiple charges. It must be remembered though that the sentence is not being negotiated, it is a plea of guilty to a particular charge or set of charges that is being decided. Cowdery (2005) has suggested that the plea-bargaining process is one of principled negotiation and it cannot proceed without informed agreement. The method of BATNA provision is the first step in providing support for this process.

Once an offer is made it must be measured against the BATNA. The step of reality testing is very important in the process of alternative dispute resolution. (Sourdin, 2005) indicates that in the final stage of the negotiation process, reality testing provides an excellent method of ensuring that parties are fully aware of the agreement they are about to reach. The plea negotiation system is in the form of shuttle bargaining, an offer followed by a counter offer. The defence lawyer evaluates the quality/benefit of the offer and either accepts or rejects the offer and makes a new offer. The (Hall et

sentencing decision support system is being used to provide support for VLA lawyers involved in contest mentions in the Victorian Magistrates Court.

Even though the Contest Mention is conducted in front of the magistrate, prior to the commencement of the day’s sitting, there is considerable negotiation between the defence lawyers and police prosecutors as to the charges that will proceed based on pleas of guilty. If the accused decides to plead guilty to the charges filed, the charges are dealt with at the time of the Contest Mention hearing. The facts of the case are presented to the magistrate by way of a written summary of the offence. It is this written summary that is one of the key negotiation elements, especially in terms of the admitted facts. Aggravating facts need to be down played whilst mitigating facts need to be emphasized. If charges are withdrawn then the summary needs to be adjusted to represent this fact. There is no transparency in this process, as the magistrates is presented with only an altered copy of the summary and it is this summary alone that is preserved on the record.\(^{17}\) There is no formal record of this the process, nor are any reasons given to support the extremely discretionary actions of the prosecution.

Negotiation in the criminal justice system is not simply a matter of achieving a high conviction rate or higher than average sentences for criminals. There needs to be some notion of justice (Bar-Gill and Gazal Ayal 2006). Negotiation involves ordering priorities and this can be a difficult problem for defence lawyers with heavy caseloads. Decision support systems offer a way of ordering and weighing up various, often competing interests. Susskind (2000) suggests that intelligent checklists are important in reviewing compliance with legal regulations. For the domain of plea negotiation, intelligent checklists (as part of a larger support system) provide an excellent method for the prosecution to ensure that any plea-bargain that might be entered into meets all the necessary legal requirements and follows detailed prosecutorial guidelines.\(^{18}\) This results in lawyers having more accurate information and thus providing effective representation.

A defendant who receives poor legal representation in regards to plea-bargaining may find that an unfair deal is accepted; one which might otherwise have been rejected. In the United States, indigent defendants often hire defence counsel who charge flat rates. This usually increases the incentive to conduct a plea bargain (Rhode, 2004).

Enhanced negotiation support can be provided by decision support systems. Decision support systems can provide an unbiased appraisal of an accused criminal’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. Rhode (2004: p. 4) suggests that, “Court-appointed lawyers’ preparation is often minimal, sometimes taking less time than the average American spends showering before work”.

As part of the overall push to improve access to justice, decision support systems can help to achieve this goal (Zeleznikow 2002). In the United States, less than one percent of lawyers are in legal aid practice. More and more defendants are pushed to pro se\(^{19}\) defence strategies and this is increasingly becoming the norm in Australia.

\(^{17}\) In the United States a landmark ruling by the Supreme Court, Blakely v Washington, (2004) 542 US 296 has made illegal the use of any and every fact that increases a defendant’s effective maximum sentence that has not been either admitted to by the defendant or determined by a jury beyond a reasonable doubt.


\(^{19}\) A pro se litigant is one who does not retain a lawyer and appears for himself in court.
In summary, 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. 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.

5.1 Current and Future Research

As previously described, Family_Winner has recently received considerable media publicity. As a result, we have been approached to commercialise the program. Two specific projects, with Creative Binary Engineering and Relationships Australia, are taking place. Current research includes

1. 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.

2. As described above, in conjunction with the Queensland Branch of Relationships Australia, we are developing a negotiation decision support system using both interested-based and justice-based negotiation.

3. The Australian Workplace Relations Amendment (Work Choices) Bill 2005 encourages employers and employees to conduct direct negotiations about employment conditions. Previously, under a centralised decision-making process, the Australian Industrial Relations Commission made rulings about industrial 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 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.

4. We are investigating principles for the successful negotiation of Information Technology Outsourcing Agreements.

5. We are developing a Family Law Environment using our three step process of dispute resolution, so that parties to a family dispute can receive advice about possible outcomes, exchange arguments and receive mediation advice about how best the disputing parties can attain their objectives.

6. We are conducting two projects that involve the use of Information Technology to help resolve tourism disputes. The first involves developing a framework for the resolution of complaints in the hotel sector. The second project (in conjunction with a consortium of European Universities) involves developing decision support systems to help decrease criminal activities against tourists.

Currently we are about to commence two projects that investigate 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.

20 Generally conducted between unions and employer groups.
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.

While producing significant information technology and socio-legal advances, the project also develops innovative artificial intelligence techniques to help develop ‘consistent’ and ‘just’ negotiation support systems and an environment for online dispute resolution.

(Gray et al 2007) argue that rather than develop negotiation support systems that are useful in resolving legal disputes, it is more important to develop systems that provide advice about how to avoid conflicts. In domains such as family law and body corporate disputes, it is important for the disputants to have ongoing relationships once the disputes have been resolved. Hence it is vital to develop software that focuses upon developing ongoing relationships, rather than focusing upon interests, justice (using BATNAs) or power. Negotiation support systems that incorporate machine learning and planning can help in this regard.

6 Conclusion

Traditional negotiation support systems have focused upon either integrative or distributive negotiation. Whilst integrative bargaining may meet the needs of the parties involved in a dispute, it often fails to address issues of fairness or justice.

In this paper, we have considered a case study of an integrative bargaining system Family_Winner, which uses artificial intelligence and game theory to advise mediators about potential trade-offs and compromises for divorcing couples. In evaluating Family_Winner, we observed that the system concentrates on the interests of the parents, rather than the paramount interests of the children. Give that the paramount interests of the children is foremost, we developed a system, Family_Mediator, which incorporates notions of fairness (as decided by either a mediator, a family law practitioner or a decision support system) with the interests of the parents.

Plea-bargaining, on the other hand, has benefits of administrative efficiency for the prosecution and provides certainty for the defence. Because of it significance, especially in the United States, we are developing decision support systems to enhance the plea-bargaining process. We are also conducting further research on consistency and fairness of negotiation strategies that being incorporated into negotiation support systems.

REFERENCES


