

Advances in Group Decision and Negotiation

Volume 4

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The book series, *Advances in Group Decision and Negotiation* — as an extension of the journal, *Group Decision and Negotiation* — is motivated by unifying approaches to group decision and negotiation processes. These processes are purposeful, adaptive and complex — cybernetic and self-organizing — and involve relation and coordination in multiplayer, multicriteria, ill-structured, evolving dynamic problems in which players (agents) both cooperate and conflict. These processes are purposeful complex adaptive systems.

Group decision and negotiation involves the whole process or flow of activities relevant to group decision and negotiation — such as, communication and information sharing, problem definition (representation) and evolution, alternative generation, social-emotional interaction, coordination, leadership, and the resulting action choice.

Areas of application include intraorganizational coordination (as in local/global strategy, operations management and integrated design, production, finance, marketing and distribution — e.g., as for new products), computer supported collaborative work, labor-management negotiation, interorganizational negotiation (business, government and nonprofits), electronic negotiation and commerce, mobile technology, culture and negotiation, intercultural and international relations and negotiation, globalization, terrorism, environmental negotiation, etc.

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D. Marc Kilgour · Colin Eden
Editors

Handbook of Group Decision and Negotiation

 Springer

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Preface

Publication of the *Handbook of Group Decision and Negotiation* marks a milestone in the evolution of the group decision and negotiation (GDN) field. On this occasion, editors Colin Eden and Marc Kilgour asked me to write a brief history of the field to provide background and context for the volume.

They said that I am in a good position to do so: Actively involved in creating the GDN Section and serving as its chair; founding and leading the GDN journal, *Group Decision and Negotiation* as editor-in-chief, and the book series, "Advances in Group Decision and Negotiation" as editor; and serving as general chair of the GDN annual meetings. I accepted their invitation to write a brief history.

In 1989 what is now the Institute for Operations Research and the Management Sciences (INFORMS) established its Section on Group Decision and Negotiation. The journal *Group Decision and Negotiation* was founded in 1992, published by Springer in cooperation with INFORMS and the GDN Section. In 2003, as an extension of the journal, the Springer book series, "Advances in Group Decision and Negotiation" was inaugurated.

The journal and book series are motivated by unifying approaches to GDN processes. These processes are purposeful, adaptive and complex – cybernetic and self-organizing – involving purpose, relation, communication, negotiation and decision in multiplayer, multicriteria, ill-structured, evolving, dynamic problems in which players (agents) both cooperate and conflict. In short, this is problem solving by purposeful complex adaptive systems. Approaches include (1) computer GDN support systems, (2) artificial intelligence and management science, (3) applied game theory, experiment and social choice, and (4) social and cognitive/behavioral sciences in group decision and negotiation.

The four departments of the journal are organized around these four approaches. Led by Editor-in-Chief, Melvin F. Shakun, *Group Decision and Negotiation* greatly benefits from the knowledge, expertise and work of its senior, departmental and associate editors. The fundamental source of its high quality is collectively the authors of its papers. Now in volume 19 (2010), the journal publishes six issues and approximately 600 pages annually. Starting with volume 20 (2011), the number of pages will increase by about 25%.

The *Handbook of Group Decision and Negotiation* is part of the book series, "Advances in Group Decision and Negotiation". Other volumes in the book series so far concern cultural differences in resolving disputes, computer-aided international conflict resolution, multicultural teams, and an upcoming book on negotiation and e-negotiation.

Before the year 2000, GDN Section meetings were always part of INFORMS meetings. For the millennium and intended as a one-time event, the Section decided to have a meeting of its own. A very successful stand-alone meeting, GDN 2000, was held in Glasgow, Scotland, United Kingdom. The excellent papers, increased connect-edness among participants facilitated by a smaller meeting, and resulting professional synergies motivated a spontaneous move to hold a similar-type meeting in 2001. La Rochelle, France was selected as the site for GDN 2001. Meetings GDN 2002 through GDN 2010 followed with some being held as a meeting-within-a-meeting at larger INFORMS-affiliated meetings. The complete list of meetings from GDN 2000 to GDN 2010 is as follows:

GDN 2000, Glasgow, Scotland, United Kingdom
 GDN 2001, La Rochelle, France
 GDN 2002, Perth, Western Australia, Australia
 GDN 2003, Istanbul, Turkey (as part of EURO-INFORMS 2003)
 GDN 2004, Banff, Alberta, Canada (as part of CORS-INFORMS 2004)
 GDN 2005, Vienna, Austria
 GDN 2006, Karlsruhe, Germany
 GDN 2007, Mont Tremblant, Quebec, Canada
 GDN 2008, Coimbra, Portugal
 GDN 2009, Toronto, Ontario, Canada (part of CORS-INFORMS 2009)
 GDN 2010, Delft, Netherlands

The GDN Section meetings generally have been partnered with the EURO Working Group on Decision and Negotiation Support, and the EURO Working Group on Decision Support Systems. Often special issues of *Group Decision and Negotiation* have come out of the GDN meetings.

The INFORMS-GDN Section Award (Certificate) honors leading contributors to GDN research, teaching and the profession. When given, it is presented at the GDN meeting banquet for that year. Award recipients to date are as follows: Melvin Shakun (2004), Gregory Kersten (2005), Marc Kilgour (2007), Colin Eden (2008), Gert-Jan de Vreede (2010).

This brief history is dedicated to all of us: Colleagues who individually and collectively have made history in evolving the GDN field.

New York, NY

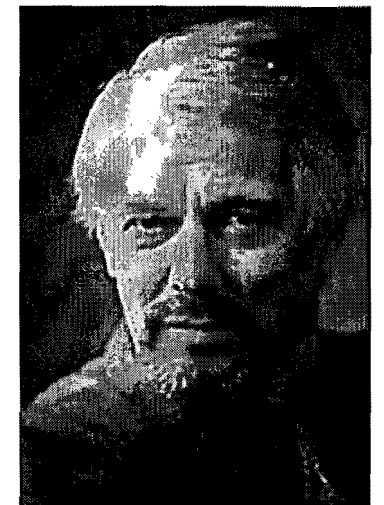
Melvin F. Shakun

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D. Marc Kilgour is Professor of Mathematics at Wilfrid Laurier University, Research Director: Conflict Analysis for the Laurier Centre for Military Strategic and Disarmament Studies, and Adjunct Professor of Systems Engineering at University of Waterloo. His main research interest is optimal decision-making in multi-decision-maker and multi-criteria contexts, including deterrence and counter-terrorism, power-sharing, fair division, voting, negotiation, and infrastructure management.



Colin Eden is Associate Dean and Director of the International Division of the University of Strathclyde Business School. He is Professor of Strategic Management and Management Science. His major research interests are into the relationship between operational decision making practices and their strategic consequences; the processes of strategy making in senior management teams; making strategy; managerial and organisational cognition; 'soft OR' modeling approaches and methodologies, including particular emphasis on the role of cognitive mapping; the theory of consultancy practice; the process and practice of 'action research'; and the modelling of the behaviour of large projects disruptions and delays, including issues of the dynamics of productivity changes, and learning curves; and the use of group decision support in the analysis, negotiation and making of strategy.



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Introduction to the Handbook of Group Decision and Negotiation

D. Marc Kilgour and Colin Eden

What is Group Decision and Negotiation?

The ability to reach informed and appropriate collective decisions is probably a prerequisite for civilization, and is certainly a valuable asset for individuals and for all types of organizations. The use of formal procedures for reaching a collective decision is often recommended, and it is widely accepted that collective decision-making can be "improved" by a systematic approach, or by the right kind of group support. Group Decision and Negotiation (GDN) is the academic and professional field that aims to understand, develop, and implement these ideas in order to improve collective decision processes. The aim of this Handbook is simple: Make the methods, conclusions, and products of Group Decision and Negotiation research and practice widely available in a form suitable for practitioners, students, and researchers.

Group Decision and Negotiation includes the development and study of methods for assisting groups, or individuals within groups, as they interact and collaborate to reach a collective decision. The broad aims of the field are to provide a range of procedures – including both analytical support and process support – that will improve, and possibly even optimize, collective decisions. The range of GDN is enormous, reflecting the breadth of the structural, strategic, tactical, social, and psychological issues faced by individuals and groups as they narrow in on a collective choice.

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The field encompasses procedures, techniques, and support systems designed to help negotiating or cooperating decision makers deal with complex issues more efficiently or more effectively. The development of GDN is an excellent illustration of interdisciplinary synergy, as approaches are combined from operations research, computer science, psychology, social psychology, political economy, systems engineering, information systems, social choice theory, game theory, system dynamics, and other fields. Moreover, this research is being carried out around the globe; for instance, the authors of this Handbook are working in Austria, Canada, Finland, Germany, Hong Kong, The Netherlands, Poland, Sweden, Taiwan, Turkey, the UK and the US.

The field of Group Decision and Negotiation boasts a large and growing research literature. A search of the Web of Knowledge database for the keywords "group decision" and "negotiation" found them to be associated with over 12,000 papers, scattered over more than 100 research areas including management science, engineering, psychology, neuroscience, political science, and many others (Web of Knowledge, 2009). The field has been catalyzed by the successful specialist journal *Group Decision and Negotiation*, which has published many of the most significant advances. Yet the sheer volume of research cannot be considered surprising in light of the observation that most of the important decisions made by corporations, governmental and non-governmental organizations, and individuals around the world amount to *decisions* made by a *group* through some form of *negotiation*.

For example, the United Nations must be a centre of negotiation if it is to achieve its aims to maintain international peace and security, foster friendly relations,

and achieve international cooperation and harmony (<http://www.hrweb.org/legal/unchartr.html> – Charter of United Nations, Chapter 1, Article 1. Accessed 29 April 2010). These negotiations must involve not only national governments, but also regional organizations, non-governmental organizations, and other groups. Similarly, corporate and governmental organizations are in a constant state of negotiation as they forge group decisions, develop policy, and make strategy. At the individual level, negotiations remain crucial, not only in interpersonal relations, as in the family, but also as individuals relate to each other and to government or corporate organizations. In recent times, electronic communication, including e-negotiation and e-negotiation systems, sophisticated computerized group support systems (GSS), and even text messaging, have revolutionized negotiation practices and created important new negotiation problems. All of these aspects of GDN are considered in this Handbook.

The field of Group Decision and Negotiation exhibits both unity and diversity. For example, in one part of the field, scholars find it useful and appropriate to distinguish between group decision making and negotiation. They understand *group decision* as a decision problem shared by two or more concerned parties who must make a choice, for which all parties will bear some responsibility, while seeing *negotiation* as a process in which two or more independent, concerned parties may make a collective choice, or may make no choice at all. An alternative view is that *group decision* is a generic process whereas *negotiation* is a specific process (Walton and MacKersie, 1965). An important difference, though not a characterization, is that negotiation often implies a distributive dimension that group decision almost always lacks. These distinct viewpoints reflect not only the possible outcomes, but also the process, the numbers of participants, the existence of common ground, and the types and modes of participation. In yet another part of the field, the terms *group decision* and *negotiation* cannot be disentangled – group decisions arise through subtle or “soft” social and psychological negotiation. In the *Handbook of Group Decision and Negotiation*, we accept all of these perspectives, and more. Our aim is to introduce them to the reader, and to convey an idea of their implications. As we do so, we will cover the field of Group Decision and Negotiation as it is now, and as it seems likely to develop in the future.

Organization of the Handbook

The Handbook is in four parts.

- I. The Context of Group Decision and Negotiation. In this section, the stage is set for understanding GDN by focusing on the ingredients, the inputs, and the media.
- II. The Analysis of Collective Decisions. In this section, collective decision processes are modeled and analyzed, mainly using methods related to or inspired by game theory. Normative or prescriptive procedures related to these methods are also introduced here.
- III. Facilitated Group Decision and Negotiation. In this section, attention turns to support systems aimed at facilitating a group in the structuring, analysis and negotiation of decisions.
- IV. Electronic Negotiation. Here, the special nature of electronic negotiation is explored, and the implications of its rapid growth developed.

Parenthetically, we note that Parts II and IV are grounded in the notion of a separation between decision and negotiation, whereas Parts I and III make only fuzzy distinctions between these two aspects of GDN.

Part I: The Context of Group Decision and Negotiation

The first part of the Handbook provides context for the analysis, understanding, and support of group decision and negotiation. Here the groundwork is laid for the specific approaches that are described in the three remaining parts of the Handbook.

Andrzej Wierzbicki begins by setting GDN in the wider societal context. His chapter is adventurous in its theoretical perspective, discussing the informational revolution, the dematerialization of work, the conceptual revolution, and the change of episteme. The chapter is far-reaching; its conclusions constitute an appeal for new concepts and approaches that can form a basis for theories of group decision and negotiation at a higher level. Wierzbicki's views are interesting and challenging, though not necessarily shared by other authors!

Julie Rennecker, Alan Dennis, and Sean Hansen introduce a significant shift in negotiation behaviours in organizational meetings. They talk of *invisible whispering* through the use of instant messaging devices. New technology, used by all managers (and most people), is facilitating different forms of conversation within meetings – a conversation that goes beyond what is heard and seen by all of the members of a group. Thus, although the last two decades have seen the introduction of carefully designed computer-based group support systems, there is now a potential for designing sub-group support using personal digital assistants (PDAs).

We mention above the notion that group decision and negotiation is embedded in organizational settings. **Christer Carlsson** reports a case study of a decision with serious consequences – a situation that he calls a “hard decision”. He reports on how modelling approaches can influence hard decision, and in particular help a group frame their decision problem. He provides a sense of the breadth of considerations that typically make up a group decisions and negotiation.

Needless to say, a difficult and yet pervasive issue throughout GDN is the role of emotion, a dimension that has been notably missing from prominent theories of argumentation and negotiation. Emotion is the focus of **Bilyana Martinovski** in her chapter on emotion in negotiation. She describes how linguistics, Ethnomethodology, and neurology contribute to the understanding of face-to-face negotiation, showing the crucial role of emotion and language in the process of reaching an agreement – or failing to do so. Her discussion is not restricted to face-to-face negotiations, but continues with the role of emotion in computer-mediated group decisions and even in virtual-agent models of negotiation.

Melvin Shakun makes an equally bold investigation into the wide range of influences in reaching agreements. He views the process of developing and accepting agreements as an essentially human enterprise, extending from emotion to spirituality, and introduces the notion of connectedness in problem solving and negotiation. He sets his ideas of connectedness in the context of many other approaches to GDN, creating an instrumental analysis of the nature of agreement that encompasses the wider aspects of humanity.

Cecilia Albin and Daniel Druckman discuss the role of justice in negotiation and, in particular, its importance in achieving enduring agreements.

Drawing on data from peace agreements, many to end civil wars, they compare the roles and consequences of distributive and procedural concepts of justice, and many other factors, in assessing whether a good outcome is feasible or likely. They emphasize the importance of context and the essential role of fairness and equal treatment in achieving an agreement that the parties are willing to live with.

Sabine Koeszegi and Rudolf Vetschera view communication as the heart of negotiation, and use it to tie together the hard and soft factors that produce agreement. They provide an overview of methods of analyzing information exchange that allows for the complexity of communication processes, locating these methods along the dimensions of inclusiveness or selectivity of information and micro- or macro-level analysis. They gain valuable insights by combining these dimensions in different ways, and end by proposing a multi-method approach for the analysis of negotiation processes.

Part II: Analysis of Collective Decisions: Principles and Procedures

The underlying theme of the second part of this Handbook is choice, by individuals and by groups. The most general level of consideration is game theory – non-cooperative and cooperative. Voting and fair division are group choice procedures that can be analyzed game-theoretically since they integrate individual decisions into a collective choice. Conflict analysis methods and drama theory are two different developments from non-cooperative game theory, the first concentrating on prescriptive analysis on behalf of individual decision makers and the second on dilemmas that accompany in changes in preference. Most of the contributions in this part of the Handbook have connections to Game Theory, and in many cases are developments that can be traced back to the *Theory of Games and Economic Behavior* (Von Neumann and Morgenstern, 1944).

Kalyan Chatterjee leads off with a description and development of non-cooperative game models of bargaining, which can be thought of as the underlying process of negotiation. Game Theory was divided into cooperative and non-cooperative branches by von

Neumann and Morgenstern; early models by Nash within the cooperative branch remain the most influential, and initially non-cooperative approaches aimed simply to flesh out those models by including more explicit descriptions of the processes. Later developments raised many new questions pertinent to the understanding of negotiation, such as the role of outside options and the development of coalitions in multilateral contexts.

Next, **Özgür Kibris** describes the rich array of cooperative game approaches to negotiation. He describes in detail Nash's concept of a bargaining problem and the axiomatic method usually applied to assess possible rules or solutions. An axiom is simply a property of a bargaining rule, usually seen by the researcher as desirable. Typically, cooperative bargaining theory begins with a set of axioms, motivated by a particular application, and identifies the class of bargaining rules that satisfy them. Many bargaining rules presented here can be characterized by the sets of axioms that define them. The relation of cooperative to non-cooperative approaches to bargaining is also addressed, culminating in a brief assessment of the Nash program and issues of implementation and manipulation of bargaining rules. Finally a few ordinal bargaining rules, which do not assume von Neumann-Morgenstern preferences, are presented.

As **Hannu Nurmi** points out in his contribution, voting systems are common ways of resolving conflicts, choosing candidates, selecting policy options as well as of determining winners or ranking competitors in various contests. There are many voting systems; it is an important, but perhaps unsurprising, fact that different voting systems often produce widely different outcomes when applied to the same set of voter inputs. Plausible outcomes can sometimes be singled out, and many classical paradoxes of voting arise as voting systems fail to produce the outcomes that "ought" to be selected. More generally, various plausibility criteria for the evaluation of voting systems have been proposed. The advantages and disadvantages of making collective decisions by voting become apparent from this survey.

The problem of fair division is the puzzle of how to allocate fairly some divisible item, or set of items, to a group of individuals whose tastes are different. The "I cut, you choose" method of allocation to two children is an example of a fair division procedure; in general, fair division procedures ask individuals for input which is then translated into an allocation that,

in principle, each individual will find fair. **Christian Klamler** surveys these collective-decision procedures, emphasizing algorithmic issues as well as the properties that outcomes may exhibit. He includes procedures for many prototypical problems of fair division, including cake-cutting, pie-cutting, and cookie-sharing.

Marc Kilgour and Keith Hipel provide a survey of the class of conflict analysis methods that have been developed to retain some features of non-cooperative game theory, including the focus on individual choice, while easing the problem of model construction and analysis interpretation. These techniques can model and analyze a strategic conflict, or policy problem, using models of the purposive behaviour of actors. They then concentrate on the Graph Model for Conflict Resolution, a methodology that stands out for the flexibility of its models and the breadth of its analysis. The graph model system is prescriptive, aiming to provide a specific decision-maker with relevant and insightful strategic advice. Considerable experience has now been gained with the decision support system GMCR II, which can be used to apply the graph model. The presentation ends with a summary of new developments that will characterize the next generation of the software.

Jim Bryant surveys Drama Theory, another development from non-cooperative game theory that can be used to understand negotiation issues. Specifically, it addresses the strategic conversations that take place among parties whose individual actions are of mutual concern as they seek collective solutions to shared problems. Drama Theory provides an analytical framework for modeling such strategic collaborations and conflicts in contrast to the more prescriptive approaches of Conflict Analysis. The core concept of Drama Theory is dilemma management, an emotional-logical process whereby individuals seek to escape pressures encountered as they work with others. This chapter traces the historical development of Drama Theory and illustrates it with examples.

Part III: Facilitated Group Decision and Negotiation

This part of the Handbook focuses on group decision support. The chapters describe modeling approaches that, in most cases, are facilitated by a group support system or interactive group model building procedure.

Group Support Systems (GSS) or Group Decision Support Systems (GDSS) have been in existence for in excess of 20 years. GSSs have been used as a basis for facilitating more effective negotiation by seeking to: increase group productivity, provide anonymity, enable better collaborative working, and form a basis for visual interactive modeling. More recently, there has been an increasing interest in using them to facilitate the negotiation of an agreed strategic direction for an organization. The original developments were prompted by the interests of scholars in the field of information and computer science, and the development of *GroupSystems* at the University of Arizona can be regarded as the foundation for this work (Valacich et al., 1992; Vogel et al., 1990).

Floyd Lewis opens the section with an introduction to group support systems with an account of the development and influence of a specific support system, *MeetingWorks*. *MeetingWorks* makes use of a modeling approach that acknowledges and works with multiple, and often conflicting, criteria for decision making. It combines this modeling approach with good record-keeping and attention to consensus-generating measures.

The theme of multi-criteria decision making (MCDM) is continued in the next chapter by **Ahti Salo and Raimo Hämmäläinen**. Important decisions are often taken by groups of decision makers whose choices among several alternatives must be based on an appraisal of how the alternatives are likely to perform with respect to multiple, usually conflicting, objectives. The methods of multi-criteria decision analysis (MCDA) can generate decision recommendations and offer process support that enhances decision quality, improves communication, and simplifies implementation. This chapter reviews methods, illustrates them using case studies, and suggests guidelines for the design of MCDA-assisted group decision support.

Within the theme of GSS, **Fran Ackermann and Colin Eden** report a case study about the use of a GDSS, *Group Explorer*, to facilitate what they call "soft negotiation" where the modeling role is qualitative and specifically aimed at helping a negotiation across two organizations with a dysfunctional relationship. "Soft" negotiation seeks to enable a positive shift in the psychological and social understandings of participants. It is underpinned by propositions from the field of international conciliation where the emphasis is on reaching agreements and changing thinking.

Group Support Systems have been very successful in helping corporations reach difficult decisions, but research into their effects continues and is still important in informing the development of GDN. **Doug Vogel and John Coombes** report on recent research in the use of Group Support Systems that seeks to understand their effect on the process of convergence on the most worthy ideas to translate into knowledge. They argue that distributed and mobile convergence support may be of particular significance, especially given the preponderance of global corporations needing to access expertise across diverse global locations.

Notwithstanding these efforts to develop computer based systems such as those reported in the earlier chapters of this section, it is notable that much group support derives from group modeling. In these instances modeling approaches are used with a group directly (as opposed to in the "back-room") to help a group arrive at a policy. The field is extensive but is perhaps best acknowledged by the work of John Friend and Allen Hickling in their Strategic Choice Approach (SCA) (Friend and Hickling, 2005), Peter Checkland using Soft Systems Methodology (SSM) (Checkland and Scholes, 1999), and by those using System Dynamics modeling methods within a group setting (notably chapter by Vennix (1996) and Richardson and Andersen, in this volume). In this Handbook **George Richardson and David Anderson** explore the GDN role of group model building for systems thinking, mapping, and modeling for public policy making.

A similar vein of developments is considered by **Teppo Hujala and Mikko Kurttila** in connection with facilitated group decision making in hierarchical contexts. Their case study explores negotiation hierarchies in natural resources management, and how to deal with them. The importance of both soft and hard methods of analysis and their role in seeking consensus or agreement is stressed.

The final chapter in this section, by **Gwen Kolfshoten, Gert-Jan de Vreede, and Robert O. Briggs**, shifts the field from the technical sophistication of GSSs and group modeling methods to the important aspects of effective group work. Their starting point is to suggest that there might be ways of helping groups facilitate themselves through design collaboration engineering tools. Thus, they report on the design of collaborative work practices for high-value recurring tasks, and the use of those designs for

practitioners to execute for themselves. The idea of self-facilitation opens up the possibility for GDN to be supported very widely across organizations.

Part IV: Electronic Negotiation

One major impact of the internet is its ability to link individuals – and whenever individuals can communicate, they negotiate. The history of electronic negotiation began with the use of internet as a communication device. (For a brief review of e-negotiation, see Kersten, 2002.) It was soon recognized that electronic negotiations are a useful research tool because they provide the capacity to regulate and monitor negotiator communication, and to make it available for analysis. Recently, electronic negotiating agents in various forms have been developed and placed on the internet; they regulate human negotiation, and negotiate with humans and with each other. The rapid growth and developing implications of electronic negotiation are the theme of this part of the Handbook.

Gregory Kersten and Hsiangchu Lai provide a sweeping overview of the field of electronic negotiation, beginning with a history of software used to conduct negotiations and assist negotiators. Negotiation models and systems have come from computer science, management science, engineering, management information systems, psychology, and communication research. Kersten and Lai focus on the relationship between the design and engineering of e-negotiation systems and the socio-psychological and anthropological aspects of negotiations involving people. They relate negotiation process models, e-negotiation taxonomy, the design of exchange mechanisms, and protocol theory. They also review several e-negotiation systems currently used in business and academia, including some for supply chain systems and some for negotiation training.

Jamshid Etezadi then addresses the question of what determines whether an e-negotiation system is adopted and used. He begins in the Information Systems literature, explaining the uniqueness of negotiation systems and proposing guidelines for modeling and measuring their adoption and use that are major modifications to the standard models of technology adoption. He goes on to assess some specific models that relate to the role of affect in negotiation and

the impact of “incidental emotion,” proposing a general conceptual model for adoption of e-negotiation systems that incorporates negotiation affect. He undertakes some tests of the validity of the model using a large dataset, and concludes with some recommendations for future research.

Mareike Schoop’s chapter concerns process support for human e-negotiators. Successful support systems not only increase the value of electronic media for negotiation, but also develop links between negotiators, and strengthen organizations. To achieve these successes, a negotiation support system must provide integrated support for all aspects of the negotiation processes – decision making, communication, and document exchange. In this chapter, these issues are addressed in terms of the organizational objectives, communication theory, and document management. As an example, the Negoisst negotiation system is described in detail and used to illustrate sophisticated support for complex electronic negotiations applicable across a wide range of contexts.

Recent developments have created a need for online dispute resolution services, and **Ofir Turel and Yufei Yuan** describe some that have recently become available. For example, e-disputes arise frequently among buyers and sellers using online auction systems such as eBay, and online dispute resolution seems a natural way to help disputants address their problem. The need for online dispute resolution and its history are described briefly, and then currently available services are described and classified. One promising type, principle-based dispute resolution, is described in detail and analyzed using concepts of justice, which has some unusual aspects when delivered entirely in the context of the world-wide web. The issue of when users will voluntarily accept online dispute resolution is explored in detail, with some conclusions that make interesting comparisons with those of other chapters.

The concluding article in this final section is **Katia Sycara and Tinglong Dai’s** description of negotiating agents. The contrast the social science and mathematical science investigations of negotiation, focusing in the latter group on both analytical models that describe optimal decision-making and computational models that attempt to calculate it. Computationally, the objective has been to find, quickly and at acceptable levels of computational resources, strategies that are optimal or nearly optimal, using suitable approximations and heuristics as appropriate. The authors review some

important ideas in both the analytical and computational streams, and describe their implementation in autonomous processes, or agents, so as to incorporate realistically some crucial aspects of negotiation such as argumentation, information seeking, and cognition, and then to engage in negotiations in a decentralized context. Such models can substitute for human negotiators and, in addition, promise to contribute to our understanding of human information processing in negotiation. They hold the potential of a new generation of decision support for human negotiators.

Conclusions

Our objective as we prepared this Handbook has been both to recognize the past and to look to the future. Throughout its development, the integrative approaches of Group Decision and Negotiation – studying problems using broad social science principles, analyzing them mathematically, or developing algorithms and software for them that incorporate managerial principles – have established the distinctiveness of the field. GDN has achieved some successes on its core problems, even though they are usually ill-structured and dynamic, precisely because they are suited to so many different perspectives. As much as the commonalities of the problems it addresses, it is the interplay of different forms of reasoning and different procedures that characterizes this unique field.

We felt it appropriate that the Handbook of Group Decision and Negotiation should emphasize both the diversity and the integrity of the field. The process of reaching a collective decision can be studied both in theory and in practice; problems can be understood in terms of underlying principles or computational issues; ideas from other disciplines can be adapted to build systems that address real problems, but only after appropriate modification, which is usually substantial.

Group Decision and Negotiation has succeeded in making an impact on theory and practice, we believe, and we believe that it will continue to succeed, but nonetheless we recognize that it faces great challenges. As we look to the future, we are very aware of the

relevance of new technological developments to the evolution of our field; there is no question that GDN as we know it today was facilitated, and even shaped, by the technologies of the past. We do not have any special qualifications for prediction, so we will not attempt to predict which issues that will emerge in the future, or which current problems that will shrink and become tractable – we predict only that the great issues of GDN will change while the fundamental problems remain the same.

And we are confident that Group Decision and Negotiation will continue to be important far into the future, and that it will continue its interdisciplinary and multi-disciplinary traditions. Up to now, it has advanced on a broad front, and this strategy has served theorists and practitioners very well. Collective decision making will be no less important in the future, and we are looking forward to making a contribution.

Equally, we are confident that there is a firm foundation for the future development of our discipline. We have done our best to elaborate it in this Handbook.

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