# ELECTRONIC NEGOTIATIONS
# Foundations, Systems, and Processes

Gregory Kersten and Hsiangchu Lai

InterNeg Research Centre and J. Molson School of Business, Concordia University, Canada
College of Management, National Sun Yat-sen University, Kaohsiung, Taiwan

**Abstract**

Electronic negotiations are conflict management and resolution processes conducted on the internet and supported with software. This paper provides a historical overview of software used in conducting negotiations and aiding negotiators. It recognizes the contributions to the design of negotiation models and systems coming from management science, engineering and management information systems as well as the more recent ones coming from psychology, communication research and computer science. Special attention is given to the relationship between the design and engineering of e-negotiation systems and the socio-psychological and anthropological aspects of negotiations that involve people. The discussion on e-negotiation systems and processes is grounded in negotiation process models, e-negotiation taxonomy, exchange mechanism design, and protocol theory. The paper reviews and analyses several e-negotiation systems used in business and academia, including negotiation software platforms used in supply chain systems as well as in research and training.



**Acknowledgments:** The publication of the InterNeg Research Papers has been supported by the Natural Sciences and Engineering Research Council, the Social Sciences and Humanities Research Council, and the J. Molson School of Business, Concordia University.

# INTRODUCTION [1]

Internet and new computing and communication technologies (ICTs) introduced novel opportunities for the design and deployment of software capable of supporting negotiators, mediators and arbitrators. They became omnipresent, entering almost every facet of our public and private lives including our social, cultural and economic activities. ICTs are also becoming increasingly active and even interventionist in their nature. This can be well observed in processes such as negotiations and mediation which involve people working together with, and communicating via computer software.

The proliferation and wide use of software has its beginnings in computer science and software engineering; the two disciplines primarily responsible for software development methodologies, software development tools, and the development of software itself. The beginnings may also be traced to management science and operation research which provided models and algorithms that make software capable if not smart, and management information systems responsible for the design, implementation and testing of many software prototypes.

Today's software are designed to support or automate *e-negotiations* and *online dispute resolution* (these two terms are often used interchangeably, sometimes indicating the domain of application rather than the system's functions), they use many of the methods, models and procedures used in the late 1970s.

Between the 1970's and 1990's many systems were designed to undertake complex negotiation tasks including conflict identification, management and resolution, search for consensus, assessment of agreement stability and equilibrium analysis. *Negotiation support systems* (NSSs) provided these functionalities by design. But there were also other types of software that incorporated tools for conflict management and resolution. Such systems as *group decision support systems* (GDSSs), *group support systems* (GSSs), and *meeting support systems* (MSSs) have functions which aim at managing and resolving conflicts (Kersten 1985; DeSanctis and Gallupe 1987; Lewis 1987; Chidambaram and Jones 1993; Fjermestad and Hiltz 1999)

The purpose of CSCW, GDSS, GSS and MSS was the facilitation of group activities and the aiding of group members in ambiguous and/or complex situations. With time, the differences between these system types blurred and on many occasions the names were used interchangeably. The reasons for this included the increasing irrelevance of user location and the synchronous versus asynchronous communication. The purpose was to facilitate communication among participants whether they were in remote locations or sitting next to each other. They facilitated synchronous and/or asynchronous communication modes, single communication medium (text) or multimedia (text and graphs), and access to information stored locally or in a distributed setting. The specific tools and functions these predecessors had included the construction of joint problem representation, identification of differences in users' opinions, aggregation of individual votes or utilities, generation of alternative solutions,

[1] This paper includes material published in Kersten, G. E. and H. Lai (2007). "Negotiation Support and E-negotiation Systems: An Overview." *Group Decision and Negotiation* **16**(6): 553-586, and Kersten, G. E. (2010). *Negotiations and E-negotiations: People, Models, and Systems*. New York, Springer. This work has been partially supported by the Natural Sciences and Engineering Research Council, Canada and "Aim for the Top University Plan" of the National Sun Yat-sen University and Ministry of Education, Taiwan, R.O.C. We thank Norma Paradis for her help in preparation of this paper.

search for joint improvement directions, and assessment of agreement stability (Fraser and Hipel 1984; Isermann 1985; Eden and Radford 1990; Nunamaker, Dennis et al. 1991).

# 1. NEGOTIATION SUPPORT AND E-NEGOTIATION SYSTEMS

The initial impetus behind ENS research and design came from academia, primarily from three areas: management science, information systems and computer science. Different interests and approaches led to the design of: (1) DSS and NSS, in which management science models were embedded, (2) relatively simple systems and e-negotiation tables for interaction supported with scoring methods, and (3) artificial software agents and knowledge-based systems. These three research areas contributed to the development of five types of systems; all are illustrated in Figure 1 (note that the boundaries are not crisp and there is significant overlapping). Several examples of these systems used in commercial and other transactions and also in research and training are given in Sections 4 and 5.

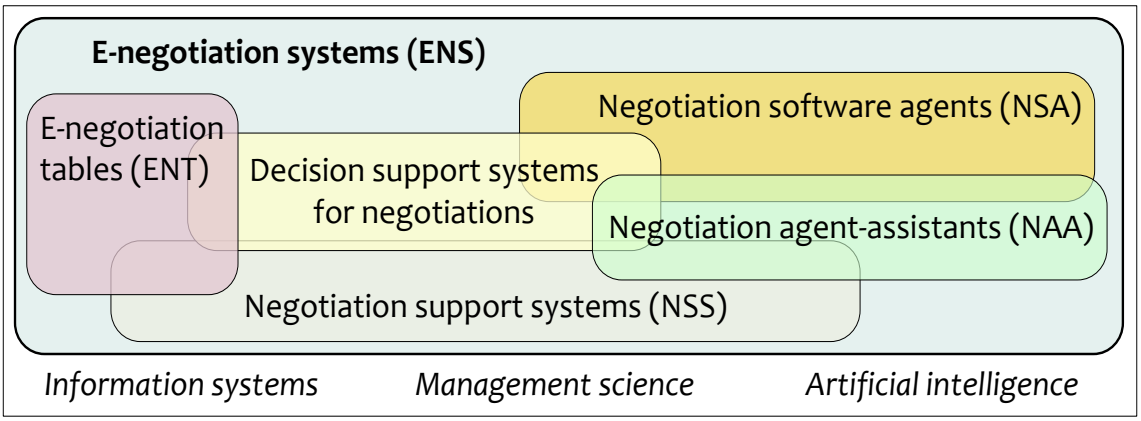


Fig. 1 Software systems in negotiation facilitation, support and automation (Kersten and Lai 2007)

## 1.1 Negotiation support systems

Lim and Benbasat (1992) noted that a negotiation support system requires all the capabilities of a decision support system (DSS), and it also has to facilitate communication between the negotiators. This is a minimum requirement; a DSS is both user- and problem-oriented. It is user-oriented because it helps the user to understand and formalize his preferences. It is problem-oriented because it helps the user to understand the problem structure, search for a problem solution, and conduct sensitivity analysis.

The fact that there are two or more participants in negotiations may require additional types of support and intelligence. Useful support involves assessment of the negotiator counterparts, help in understanding their priorities and predicting his moves, suggestions regarding possible coalitions, advice about making and justifying a concession, and so on. These support functions go beyond a DSS and obviously, they are not a part of the communication facility. Few systems however, provide all these kinds of support. Therefore, the definition used here

follows a definition proposed by Lim and Benbasat (1992), with an addition of the coordination facility (Lai 1989; Holsapple, Lai et al. 1995).

> *Negotiation support systems* (NSS's) are software that implement formal models, have communication and coordination facilities and are designed to support two or more parties in their negotiation activities.

The key assumption for a NSS system is that the decision process it supports is *consensual*. Participants of meetings and various types of group decision-making activities may attempt to achieve consensus but this is not a necessary condition for a successful result. In negotiation, the achievement of consensus regarding an alternative decision is necessary for the alternative to become the agreement. This implies that tools and features of a NSS need to be designed taking into account that its users are:

- Independent and maintain their independence;
- Can terminate the process at their will; and
- Can reject every offer and propose any counteroffer.

## 1.2 E-negotiation system definition

The internet and new computing and communication technologies introduced opportunities for the design and deployment of software capable of supporting negotiators, mediators and arbitrators. Negotiations conducted on the internet have been called *e-negotiations* (Hobson 1999; Lo and Kersten 1999).

Internet-based systems differ from other information systems in several key aspects. They are network-centric and rely on ever-present connectivity. They allow for tight integration of inter- and intra-enterprise business processes (e.g., value chain and supply chain management systems), and also allow for a large number of people accessing systems from anywhere and at anytime. Their user interface is provided by web browsers, therefore it is easy to understand and common to many different applications. Internet popularity stimulated the development of new technologies, including software agents, web services and search engines, which in turn motivated developers to build more and more capable systems.

During the dot.com hype in the late 1990s and in early 2000, a number of simple systems were set up that allowed users to log in and negotiate by posting messages. More complex systems provided access to databases, with information about potential buyers and sellers and, in the case of multiple attribute purchasing, elicitation of preferences and utility construction. Several examples of these systems are given in Section 4.

One of the key activities in e-commerce and e-business is buying and selling. In many situations this is accomplished using e-markets, which are software systems. E-markets provide communication services and support market coordination of economic activities, including negotiation services (Bichler 2001). Supply chain management systems are other examples of systems that became widely used thanks to the web and internet technologies. They include software components for negotiation between the partner business organizations (Miller and Kelle 1998; Smeltzer, Manship et al. 2003). Similarly, systems used for procurement by different levels of government may embed negotiation components (Paliwal, Adam et al. 2003). This shows that negotiation systems deployed on internet are unlike the previous

systems deployed on stand-alone computers or local- and wide-area networks in terms of the implemented mechanisms, employed technologies and, most importantly, use.

The common features of the software specifically designed for e-negotiation and systems in which e-negotiation components are built-in is that they are deployed on the internet and capable of supporting, aiding or replacing one or more negotiators, mediators or facilitators. They are called systems or components for e-negotiation, in a similar manner as e-commerce, e-business, and e-market systems (Neumann, Benyoucef et al. 2003; Ehtamo, Hämäläinen et al. 2004).

*E-negotiation systems* (ENS's) are software that are deployed on the internet and have one or more of the following capabilities:

- Support decision- making, including concession-making;
- Suggest and verify offers and agreements;
- Assess and criticizes offers and counteroffers;
- Structure and organize the process;
- Provide information and expertise;
- Facilitate and organize communication;
- Assist in agreement preparation; and
- Provide access to negotiation knowledge; experts, mediators or facilitators.

ENS'S are software specifically developed to support, aid, or facilitate negotiations. Alternatively, it may be a software component, for example, supply chain management system or e-marketplace. Software used in e-negotiation may automate selected types of activities, for example, partner notification, deadline reminders, assessment of offers, and offer preparation. It may also be used for the automation of negotiation processes (Zlotkin 1996; Jennings, Faratin et al. 2001).

E-negotiations may also be conducted using other kinds of software, the most popular being email. Every software used for communication purposes (e.g., videoconferencing, on-line collaboration and instant messaging), has been used in negotiations (Moore, Kurtzberg et al. 1999; Lempereur 2004). The limitation is that the negotiation-specific activities (e.g., logrolling, concession-making and offer comparison), are not supported.

The construction of the new interdisciplinary models and methods that span different socio-economic processes together with the increasing flexibility and convergence of technologies makes a clear-cut distinction between various systems difficult to make. A combination of an auction followed by negotiation has been used for a long time, for example, in hiring when candidates submit their resumes (a type of a seal-bid auction), and those selected on the short-list are invited for further discussions and negotiations. Models combining elements of auctions and negotiations have also been proposed (Teich, Wallenius et al. 2001; Brandl, Andreoli et al. 2003) and used, for example in sales of high-value assets (Subramanian and Zeckhauser 2005). Complex systems, such as e-market and supply chain management systems may combine catalogues, auctions and negotiations.

## 1.3 Functions

E-negotiation systems differ in their capabilities, which are determined by models and procedures embedded in them. Every ENS has communication facilities that allow the parties to interact. The communication channels may have narrow bandwidth allowing exchange of messages via email and chat, medium bandwidth allowing for exchanges of images and video, or wide bandwidth that allow the parties to interact in a synchronous (real-time) mode using voice and video. We may expect that progress in ICT, AI and other areas will expand the bandwidth and in future, allow for a more natural interaction in which all human senses may be engaged.

ENSs may support simple communication acts between the participants or provide tools that allow for complex, multimedia interactions. In general, every ENS needs to transmit and present content in a way that can be used by its various users. In addition to the basic communication functions, necessary because of the physical distance between the negotiators, ENS systems may have other functions. Selected functions and related activities that are specific to negotiations and are based on theories of individual decision-making, communication and negotiation are identified in Table 1.

Communication in e-negotiation is done via electronic media which are an extension of the interface concept and provide the first three main functions listed in Table 1, (Schmid and Lechner 1999). They may rely on models as do other types of activities, but the difference between content, problem and process modeling is in the focus. Models of communication, interactions and presentation provide insights and better understanding of data. This is achieved, for example, through the use of different visualization techniques, and the search for, retrieval of and comparison of information (as opposed to production of data and information).

What information is presented depends on: the models used to formulate and solve the decision problem; the interests, objectives and preferences of the negotiators and their counterparts; the organization of the process and the concrete activities that take place during the process; and on the knowledge provided and embedded in the system. These models provide the functions presented in Table 1, which are grouped in into the following three categories:

1. Modeling of the decision problem and the negotiator (primarily the pre-negotiation activities), including the support problem formulation and solution, and the preparation for negotiation involving strategy and tactics' formulation based on information describing the decision maker and her counterpart;
2. Modeling of the decision-making activities during the process, primarily involving an ongoing assessment of the counterpart, offer construction, counter-offer analysis, search for new alternatives, which may satisfy the parties, and stability analysis; and
3. Modeling of the activities concerned with process organization, including, adherence to the agenda, verification of the rules, and assessment of the strategies and tactics and their possible modification.

Table 1 ENS functions and activities adapted from Kersten and Lai 2007)

| *Function* | *Activities* |
|---|---|
| | *Communication, presentation and interaction* |
| Transport and storage | Transport of information among heterogeneous systems; storage in distributed systems; security. |
| Search and retrieval | Search for information; selection; comparison and aggregation of distributed information. |
| Formatting, presentation and interaction | Data formatting for other systems' use; data visualization, alternative data presentation, user-system interaction. |
| | *Problem and decision maker modeling* |
| Decision problem formulation | Formulation and analysis of the decision problems; feasible alternatives; decision space, measurement. |
| Decision-maker specification | Specification of constructs describing decision makers; preferences, measures for alternative comparison; negotiators' models and styles. |
| Counterpart | Collection of information about the counterpart and its assessment. |
| Strategies and tactics | Evaluation and selection of the initial strategies and tactics. |
| | *Offer formulation and concession making* |
| Counterpart analysis | Construction and verification of models of negotiation counterparts; evaluation and prediction of their behavior. |
| Offer construction and evaluation | Analysis of offers and counter-offers, concession analysis, formulation of offers and concessions. |
| Argumentation | Assessment of messages and arguments; argumentation models. |
| Problem restructuring | Identification of bounds, search for new alternatives, revision of the decision problem. |
| What-if, sensitivity and stability analyses | Analysis of offers and counter-offers; analysis of the counterparts' reactions; search for and assessment of the potential compromise solutions. |
| | *Process organization* |
| Negotiation transcript | Construction and representation of the negotiation history. |
| Process, and their analysis | Process analysis; progress/regress assessment; history-based predictions. |
| Knowledge seeking and use | Access and use of external information and knowledge about negotiation situations and issues arising during the process; comparative analysis. |
| Negotiation protocols | Specification of, and adherence to, the negotiation agenda and rules. |
| Verification and modification | Assessment of counterparts' of strategies and tactics; modification of strategies and tactics. |

# 2. E-NEGOTIATION ENGINEERING

E-negotiations, in which software plays an active role under the control of people or undertakes certain activities independently, require formal representation of the problem, negotiators and their interactions. Both management science (decision and negotiation analysis) and economics (utility theory and game theory), provide frameworks that can be used to organize the models and structure these interactions. Sociology and behavioral economics made significant contributions to the study of exchange processes and the design of laboratory and field experiments. Various models and procedures developed in these fields need to be put together and embedded in software in such a way that the software becomes an entity, which participates in the process.

## 2.1 Socio-technical systems

An ENS is a system that comprises information and communication technologies and is used to conduct and support negotiations. Its definition extends over to the family of systems designed to support people in their decision making activities (e.g., MIS, DSS and NSS), and allows relating ENS to other systems deployed on the web, in particular, e-commerce and e-business systems.

E-negotiation is a process that involves people and ENSs. In some processes the ENS role is passive; i.e., using email and streamed video for negotiations. More advanced systems actively participate in the process including the assessment of offers' implications, suggesting offers and agreements and critique of counter-offers (Thiessen, Loucks et al. 1998; Kersten and Lo 2003; Chen, Kersten et al. 2004). E-negotiations conducted via such ENSs are examples of socio-technical systems (Nardi and O'Day 1999).

In a socio-technical system, activities are distributed among people and software. It is therefore important that the division of labor and responsibilities be clarified. This can be done with negotiation protocols that coordinate the activities of, and the interactions among, the system's components. Protocols are necessary for software to interpret input and to be able to interact in a meaningful way with its users and other software. They allow the positioning of decision aids and other active components in the decision-making and conflict resolution process.

Protocols describe permissible activities and interactions of both people and software. Their construction requires prior formalization of behavioral models of decision making, conflict resolution and negotiation. They also require a taxonomy of activities and interactions, and rules that govern them. Both the taxonomy and protocols provide the foundation for e-negotiations.

The consideration of e-negotiation as a socio-technical system introduces two complementary perspectives:

1. e-negotiation as a system comprised of technical and behavioral components; and
2. e-negotiation as a process of the components' interaction.

This distinction is important because it helps to study the relationship between ICT and people, and the impact of people on technology and technology on people. An ENS may be a simple

component which is important but incapable of undertaking cognitively complex tasks. It can also be a system of components that perform many functions requiring knowledge and intelligence. Finally, it may act as an agent negotiating on behalf of the human principal. The consideration of an **ENS** as a socio-technical system focuses the design issues on the interaction and cooperation between the human and software components rather than viewing the use of technology as separate from the technology itself. In a sense, the users are both human and artificial agents and they need to cooperate and adapt in order to achieve goals of humans.

The consideration of an ENS as a system is consistent with the three-dimensional understanding of engineering: (1) the ENS being an artifact; (2) system construction being the design and development; and (3) the implementation and use of ENS; these three dimensions have been considered, respectively, natural, human, and social (Kurrer 2006, p. 149). This well established view on the engineering of socio-technical systems makes a clear distinction between the artifact, its use and its users. I think that we are entering an age when such a distinction is becoming difficult to make; the **ENS** provides a good example of this. Consider the following situation. A person (i.e., an agent) has been engaged to negotiate on behalf of the principal. The principal also hired other agents and he uses software agents to search for prospective clients and to collect information about markets and competitors. The agent may need to coordinate her actions with other agents both human and software, she may also have to follow their advice. This agent may use an ENS which communicates with other agents and other ENSs.

This perhaps somewhat complicated scenario is not unrealistic. If, for the sake of argument, we remove the principal from the configuration of human and software agents and other software systems (including ENSs), then it becomes clear that the users are both people and software. It is not only that one software program uses another program but also that this use is for the purpose that has been assigned by an external entity (the principal). The same goes for the human agent who uses services coming from software and other agents alike in order to meet the goals stated by the principal.[2]

The increasing capabilities of software agents that can be active and even proactive participants, indicates the need for engineering of processes in addition to systems (artifacts). It may imply that we have to engineer both human and software activities. It is also possible that we should engineer software capable of configuring itself so that it can participate in a range of socio-technical processes. This breaks the engineering into two stages:

1. Software design and development process during which various components are created; and
2. Software configuration process which takes place at the onset of the socio-technical process and also during the process, if additional components are needed.

Design and development of software components for e-negotiations require knowledge of the negotiators' requirements, concepts and constructs used in negotiations, and the possible roles of each component in a negotiation instance. This means that we need to have taxonomy of constructs and a framework of negotiation processes in which these constructs appear and take different values. These issues are discussed in Section 3.

[2] This does not mean that there is no difference between people and software. Human agents may require incentives in order to act on behalf of the principal effectively and efficiently while software does not need them. On the other hand the principal may expect from human agents a certain ingenuity and ability to cope with unforeseen situations but hardly so from the software agents.

A configuration of components is used to obtain a system where people and software are working together towards a set of goals. The part of the configuration that involves software needs to meet the process requirements; this can be obtained through the use of process protocols as discussed in Sections 4 and 5. Protocols are used to invoke components and establish communication between them. It is also possible that protocols can search for and activate software components and request that certain persons participate in the process.

## 2.2 Domain engineering

Software flexibility and ubiquity, but primarily its orientation on process and activeness (in the sense that to produce results, software has to be activated and operate) require embedding knowledge of the processes that it emulates, replaces, supports or automates. This knowledge has to be structured and formalized so that it can be embedded in software. The construction of models and procedures describing a particular area for which software is designed is known as domain engineering. Bjorner (2006) considers domain engineering as one of the three components of software engineering; the other two being requirements engineering and software design.

Bjorner's triptych of software engineering may be viewed as three phases in the long process leading to design and implementation of a socio-technical system. This process, albeit highly simplified, is illustrated in Figure 2. The simplification is that such important phases and activities, including user training, documentation, and software maintenance, are omitted. The focus is on the relationship between the theoretical and applied research and engineering and the feedback that every phase receives when the system is operational.

Figure 2 gives an overview of the two main stages of the process; the theoretical and applied research and the tool and system construction. In the first stage the process begins with theoretical and applied research, moves to behavioral studies that verify theories and their components and implementation and then to domain engineering. This last phase increasingly takes more time in research because of the necessity to use software and other systems in theory verification and modification. Domain engineering is also the first phase of the second stage, which is software engineering; its two subsequent phases are requirement engineering and software design.

The theories coming from economics, decisions science, organization science, and other areas and the behavioral concepts, models and processes formulated and verified in management, psychology and sociology provide us with knowledge. This knowledge may be used in many ways and for many purposes. To construct systems we need to structure and represent it so that system developers can use and implement it. This appropriately structured knowledge relevant to negotiations is what I call the e-negotiation foundation. Software engineers may assume that its construction is belongs to engineering, domain specialists, however, may consider this being their job.

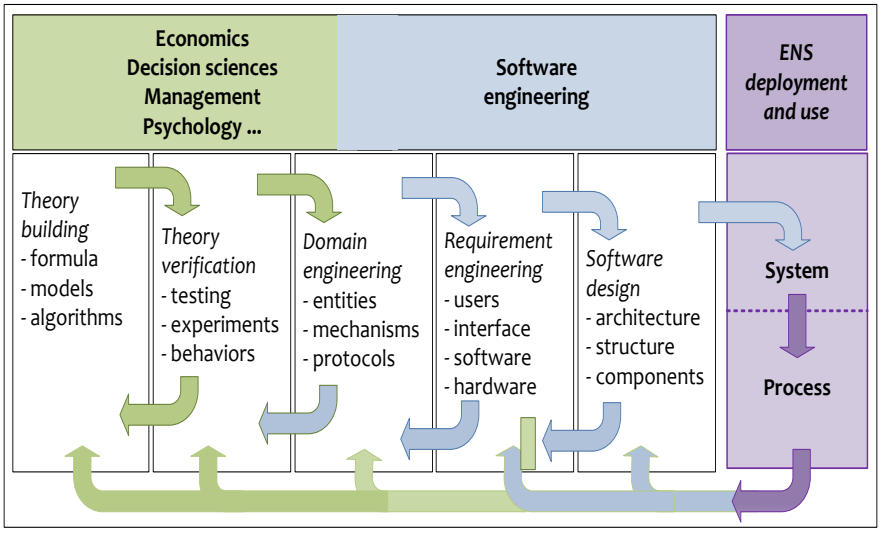


Fig. 2 From science and humanities to engineering to an IS artifact

Domain engineering provides the bridge between general, theory-building modeling and experimentation and the concrete artifacts that people and organizations use and which implement the insights from the theoretical models and experiments. We may view it as belonging to engineering or as a part of applied research; often it belongs to both as it is shown in Figure 2.

The purpose of the theories is to discover principles and rules and understand their applications and implications. The purpose of domain engineering is to design processes and mechanisms which are: (1) sufficiently detailed to be constructed and used; and (2) robust and capable of dealing with complications. Both may not be necessary in theoretical research but are essential if the artifacts are to be used in real-life rather than in a laboratory.

Roth gives an excellent example of domain engineering in economic sciences, it is "the part of economics intended to further the design and maintenance of markets and other economic institutions" (2002, p. 1341). Based on computationally tested and verified market mechanisms designed in economics, thousands of e-market systems have been designed and implemented in the form of software (e.g., eBay, Amazon and Alibaba). Other examples of the construction of economic mechanisms and entities mentioned by Roth are incentive systems, negotiating platforms and contracts (op. cit.).

Domain engineering involves the formulation of descriptions that are useful for the requirement specification and the design of the ENS. Note that I refer here to an ENS, but this may be any other socio-technical system in which software plays important functions (e.g., health, transportation and e-market). The descriptions include the entities participating in the negotiation, their goals and constraints, functions and activities, and their behaviors. They also include external information used by the entities, the information they produce, and the transformation functions.

The entities engage in individual and joint activities that follow certain rules. These sets of rules can be represented as models and mechanisms. In the world of information, they govern

the flow and processing of information. Often the terms *models* and *mechanisms* are used interchangeably (in economics, mechanisms are also called institutions). Given the imprecise meaning of both, often models have a more theoretical connotation while mechanisms—practical.

Countless studies produced a very large number of models, many of which can be adapted and become mechanisms that people may employ. For the purpose of e-negotiation, mental models that negotiators use and models that can aid them need to designed in such a way that they can be embedded in e-negotiation software (Kersten 2002; Kersten 2003). It means that models need to be computationally tested and their use and usefulness verified in laboratory and field experiments.

## 2.3 E-negotiation taxonomy

A uniform taxonomy of concepts is useful in research but it is necessary in software engineering. It is required to describe entities, their functions and behaviors, mechanisms and protocols. The uniform and complete list of terms and their meanings, which may be obtained from a taxonomy and/or ontology, are preconditions for software development. Domain research (e.g., economics, management and psychology) did not produce a taxonomy that would be useful for system design and development. Only recently, however, researchers from outside the field of computer science and engineering became interested in and involved with the design of computational models and mechanisms.

### 2.3.1 Montreal e-negotiation taxonomy

Ströbel and Weinhardt (2003) formulated the first comprehensive taxonomy for e-negotiations, which became known as the Montreal e-negotiation taxonomy. It is based on the media reference model (Schmid and Lechner 1999) comprising four phases of user-system interactions (Figure 3):

1. Knowledge phase involves gathering information;
2. Intention phase focuses on the specification of offers;
3. Agreement phase identifies terms of transaction; and
4. Settlement phase focuses on the contract execution and fulfillment.

Media, in the media reference model, are software platforms which participants use to exchange information and negotiate the terms of an agreement. The exchange is focused on the commercial transactions concerning the exchange or ownership transfer of objects or rights to services. A contract is the sole outcome of negotiation within the framework of the media reference model.

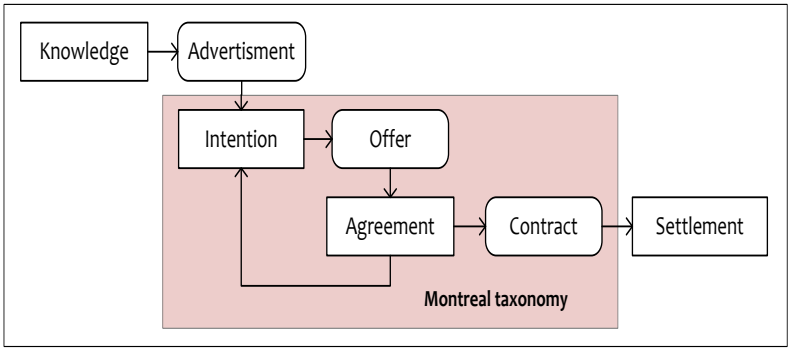


Fig. 3 Media reference model interaction phases

The concept of a transaction may be applied to many negotiation situations. Diverse negotiations such as trade, employment, union-management and divorce may be considered from the perspective of the parties engaging in transactions that involve one or more objects. Even in these negotiations, however, and in negotiations involving family members, friends and business partners, some of the issues are not only intangible but also often not explicitly negotiated. Trust, empathy and realization of common interests are outcomes that have, in some situations, a higher priority than the agreement itself.

Other limitations of the media reference model that follow from its commercial orientation include its narrow perspective on the role of the negotiation planning and preparation, and short-term orientation. Complex negotiations require learning about oneself as much as about the problem and the counterparts. This includes formulation of reservation and aspiration levels, BATNA, and preferences. It also includes the consideration of ones own profile and orientation, and thinking about appropriate strategies and tactics. Another important activity is retrospection and the creation of knowledge gained from the completed negotiation.

The above limitations notwithstanding, two phases of the media reference model have been successfully used to build up the Montreal taxonomy (Figure 3). The interface between the intention and the agreement phase is an offer (bid). In the simplest case the offer is accepted; an example of this situation is the buyer's acceptance of a posted price. The negotiation takes place if the offer is rejected and either a counter-offer or a request for another offer is made (Ströbel 2003, p. 42).

The Montreal taxonomy, like the media reference model, is restricted to business transactions and focuses on commercial negotiations and on-line auctions. It can be used for the design of fully and partially automated auctions. It extends earlier classification systems that solely focused on auctions (Wurman, Walsh et al. 2001) and automated negotiations (Lomuscio, Wooldridge et al. 2001).

The taxonomy contribution is to afford a more structured and methodological e-negotiation engineering approach through the formulation of (Ströbel and Weinhardt 2003, p. 145):

1. A common set of terms and constructs with a well-defined classification criteria,
2. Dimensions of electronic negotiations and their interdependencies.

The taxonomy provided Ströbel (2001; 2003) with the support for the selection of the right ENS

for a given negotiation scenario. It also helped him in the conceptual design of specific e-negotiations and supported the abstraction necessary for the development of generic e-negotiation engines for the SilkRoad software platform. The use of taxonomy allowed for the specification of entities and their functions. This coupled with the formulation and engineering of interaction protocols, made the generation of different classes of e-negotiation and auction systems possible.

SilkRoad had been extensively tested but, after the principal developer left, the project did not continue; it remained a proof of concept, albeit very successful. It led to several other projects, including Quotes (Cerquides, López-Sánchez et al. 2007) and Invite (Kersten, Chen et al. 2008).

### 2.3.2 Phases and key constructs

For the purposes of description, analysis and design it may be useful to aggregate atomic and very detailed constructs into an aggregate of higher-level constructs. The first-level constructs that are associated with the phases are listed in Figure 4.

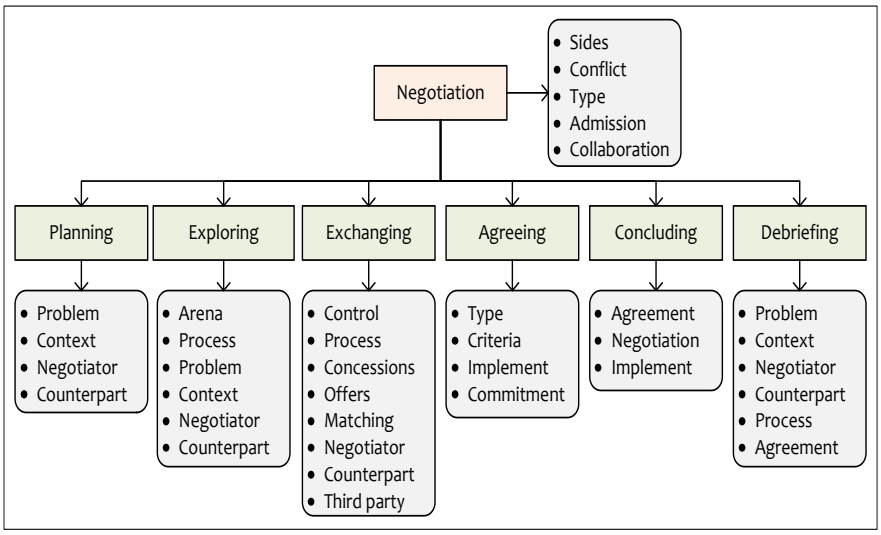


Fig. 4 Negotiation phases and top-level constructs

The constructs associated with each phase are either atomic or they can be further decomposed into the second level constructs. Similarly, the second-level constructs may be atomic or require further decomposition until an atomic construct can be determined with which a set of values is associated.[3] Construct decomposition is described in the sections below. Its purpose is to obtain a set of values for each construct and lower level constructs that uniquely define the negotiation.

Some constructs, for example *arena* and *offers*, are unique to a single negotiation phase. Other constructs are considered in more than one negotiation phase. This is because their

[3] There is no given a priori decomposition stopping rule. The number of taxonomy levels and its granularity depend on the domain and software engineering requirements. A rule of thumb is to continue decomposition until the lower level-construct has operational relevance, e.g., is a parameter or variable in a model.

formulation is initiated in one phase and continued in the subsequent phases. For example, the specification of the problem and the negotiator requirements, objectives and preferences take place in the planning phase. Information obtained during the initial discussions that take place in the agenda setting and exploring phase allows further problem specification and revision of the description of the negotiator. During the offer exchange phase both the problem and the negotiator's description may be further specified. This occurrence of some constructs in two or more phases assures that information produced in one phase is used to modify the construct formulation undertaken in an earlier phase.

The first-level constructs given in Figure 4 and their values or sub-constructs are discussed in the following sections. It may be worth pointing out that they are not unique to e-negotiation and appear also in face-to-face negotiation and those conducted via exchange of letters and other documents and telephone. In face-to-face negotiations the values need not be determined a priori because some of them may be obvious (e.g., if the negotiation is bilateral), some may be ignored (e.g., the offers format), and others only vaguely understood (e.g., the counterpart's approach). In e-negotiation determination of these values is necessary because they are used to the ENS design and its configuration of the particular process, and the allocation of tasks between the users and the ENS.

### 2.3.3 Negotiation constructs

Four constructs define the general design of the negotiation; they describe the conflict, negotiation type, admission of the participants, and their collaboration. These constructs and their possible values are listed in Table 2.

The first construct *sides* defines the initial set of participants; there may be two sides or a third party may be involved from the outset; each side may be represented by one or more persons. The negotiation may be conducted by an agent on behalf of the principal or directly by the principal.

Table 2 Negotiation constructs

| *Construct* | *Lower-level construct or values* |
|---|---|
| Sides | Single negotiator, group, agent, third party |
| Conflict | Interests, power, values, mixed |
| Type | Bilateral, multi-bilateral, multilateral, mediation, arbitration, mixed |
| Admission | Open, restricted, closed |
| Collaboration | Prohibited, limited, allowed |

*Conflict* defines the underlying reason for the negotiation and it has four sub-categories: interests, power, values and mixed, which includes a combination of elements of the first three subcategories. Conflict of interest may be economic as is the case in trade, business transactions, and contracting. It may also involve social interests that take place in social groups such as a family, group of friends, neighbors and bands. Conflict of interest occurs also within and between organizations, however often it is mixed with conflict of power. Conflict between politicians and political organizations is typically power-based. Conflict of power also

occurs in other social groups.

Conflict of values is caused by the incompatible values and norms to which individuals, groups and societies subscribe. It may be of religious, political and social nature; it may be due to culture and tradition.

The third construct is *type*. The type may be bilateral, multi-bilateral and multilateral (see Table 2). The e-negotiation may also involve a third party from the outset, human or artificial, who actively participates in the conflict resolution process. The third party may be a mediator or an arbitrator playing a similar role as in traditional mediation and arbitration.

I should mention, that "mediation" is understood here differently than in the early studies of "computer-mediated communication" (Hiltz and Turoff 1978) or "electronically-mediated negotiations" (Moore, Kurtzberg et al. 1999). Mediation means that a separate entity is actively involved in the conflict resolution process undertaking purposeful activities, the aim of which is to find an acceptable agreement and/or help the parties to reach an agreement. This entity may be a person who interacts with the parties via an ENS or a software system that is either a component of the ENS or a separate system (e.g., software agent).

Similarly, arbitration involves an entity that can be a person or software acting like an arbitrator in traditional negotiations.

The six negotiation types listed in Table 2 differ in the number of participants and their roles. The first five types I discussed earlier. The sixth type is *mixed* and it is a combination of two or more other types. Ströbel and Weinhardt (2003, p. 153) distinguish between a single-stage and multi-stage negotiations. In a single-stage negotiation the rules are uniform during the process; in a multi-stage negotiation, different sets of rules are applied in each stage. This allows for mixing types, for example, in the first stage the negotiation is bilateral, and in the second stage it moves to mediation. An example of three-stage process is a multi-bilateral negotiation followed by bilateral negotiations followed by arbitration.

The fourth construct is *admission*: it may be open allowing every person to join the process, restricted to some persons or limited to the negotiators who initiate the e-negotiation and closed to everybody else. The admission value "restricted" is another example of a sub-category with several possible values. Restriction may be due to time, for example, parties may join only once the first offer is submitted. Restriction may also be due to a profession, license or another criterion so that only persons who meet the criteria may join.

The fifth construct is *collaboration*. Collaboration may be allowed and the participants may freely exchange information in order to achieve an agreement. They may also build coalitions. In some multi-bilateral negotiations, however, such as contracting, the parties are prohibited from collaboration.

## 2.4 Mechanisms

The term *mechanism* has been increasingly used outside of sciences and engineering (e.g., sociology, economics and management) to indicate the more applied concept and complement model which has more of a theoretical connotation. A difference related to practice/theory is

the purpose; models are constructed and used to study, learn and understand while mechanisms are built and used to increase the welfare of their users. This distinction is made here to organize the discussion, but the differences are not sharp and the terms are often treated interchangeably.

The mechanisms in which we are interested, are implemented in software and it is the only practical way they can be used. Every model and algorithm may be implemented in software. Some must be computationally verified and tested, and may need to be modified so that they are robust and capable of achieving their purpose in different circumstances. The result of such model modification is a mechanism.

Another differentiating characteristic between models and mechanisms is their user-orientation. The purpose of a model is to verify a theory and/or understand a phenomenon and its implications. The purpose of a mechanism is to help its users to achieve such concrete outcomes as money, job, school placement, product and service. Therefore, mechanism design has to be approached with users in mind; users capabilities and needs must be taken into account so that they are able to achieve desired results.

Many mechanisms have been constructed and many more will be; they are engineered for the purpose of supporting, aiding and automating almost every human activity. In this section, mechanism design approach and framework are discussed. Market mechanisms are one of the successful results of design and engineering in economic sciences. Mechanism design approach has been used in other areas, including the construction of preference mechanisms used in NSSs and ENSs.

Mechanisms are used by participants (people and software) who need to achieve concrete outcomes that the mechanisms are designed to realize. The underlying assumption for the mechanism design is that the participants are outcome-oriented.

Mechanisms consist of rules that manage the process of their usage, govern the participants' permissible activities and their contribution to the outcomes. The mechanism's contribution to the outcome achievement defines its performance. It is achieved for the mechanism's users who differ in their capabilities, beliefs, information and preferences (Milgrom 2004, pp. 35-43). This concern about mechanism users and their characteristics is what, on one hand, distinguishes mechanisms from models and other theoretical concepts, and, on the other hand, makes mechanism design similar to information system design. A mechanism, sometimes called an engine, is one of the key components, of software.

The construction and selection of the rules, which is the *mechanism design*, has the purpose of achieving expected performance for various configurations of users, their types, and outcomes. The rules define the message (also called strategy) space for each user and the outcome functions which map messages into decisions and outcomes.

Jackson (2003, p. 6), addresses this key issue by stating: "The mechanism design problem is to design a mechanism so that when individuals interact through the mechanism, they have incentives to choose messages as a function of their private information that leads to socially desired outcomes." This purpose statement refers to social and economic mechanisms; they should be used in order to increase social welfare. Many economists have also repeated this, but it is at odds with, for example, biologists who

study defense mechanisms and engineers who design tools and machinery. It is at odds because the latter mechanisms are used to benefit their users explicitly and, in the case of constructed mechanisms, also not to harm other people.

Whose interests guide the design of a mechanism is a critical issue and the assertion that it benefits all is only partially satisfactory. The outcomes of mechanism's may be socially desired or not and this depends on the relationship between the mechanism users and all members of the society. This is because the maximization of the social welfare function is restricted to the mechanism's users. If the users are a small fraction of the society, then the mechanism may not produce socially desired outcomes. We may easily rectify this shortcoming by making an assumption that the outcomes are measured with money and they reflect social values.

Many economic mechanisms are designed with this assumption which may be difficult to accept for solving difficult, socio-economic problems. Putting aside this issue, albeit very important, this assumption also results in the consideration of every participant according to the participant's profile (e.g., preferences, risk attitude and wealth). Some participants may, however, wish to make the mechanism work "a bit better for them than for the others". These special participants may decide that unless they do not extract a surplus they do not want to use the mechanism. In effect the mechanism designer may tweak the design or suggest the special participants to extend their description with some additional concepts. For example, a seller in one auction may be told by the designer (who knows that there are irrational buyers) to introduce a high reservation level that exceeds her total cost of the good.

## 2.5 Protocols

Negotiation constructs can be used to describe the negotiation and its structure. They also help in specifying the permissible negotiators' behaviors and conditions for their movement through the process; such a description is known as a negotiator protocol (Ströbel 2001). This view of the protocol deals with different communication acts but not with their content. It restricts the participants' moves but gives them the freedom of doing anything they wish when they are in a given state.

Software agents do not have yet the degree of intelligence and common sense to allow them effective functioning when their communication content and form is not prescribed. In automated negotiations and also when software agents' aid people, the content of the agents' communiqués is determined by a protocol (Muller 1996). Not only software agents may need such a protocol; human negotiators may also need help in making sure that they communicate using the language and terms that convey the intended message and the form that is acceptable to the recipient (e.g., is polite and dutiful).

Protocols may also guide the actions of both human and software agents' independent activities, such as preference assessment, search for a counterpart, and offer analysis decision. Such a protocol guides the agents through the decision-making, helping them to engage in an informed and justified process by, for example, suggesting that they consider their needs and objectives, and available resources.

When we discuss protocols it is useful to consider three principal categories of negotiation: (1) decision and choice; (2) language; and (3) process (Muller 1996). Each category addresses a

different question:

1. Decision and choice: What to communicate?
2. Language: How to formulate the message?
3. Process: When to present the message?

The categories, their relationships to the negotiation and their main constructs are illustrated in Figure 5.

*Decision and choice* involve all activities that a negotiation participant undertakes individually and without involvement of her counterparts. These activities include the person's consideration of the relevant attributes and preferences, formulation of reservation and aspiration levels, and the specification of feasible and acceptable alternatives. They may follow the prescriptions of decision analysis and they may be supported with decision aids. In this category we also have individual activities which directly pertain to the negotiation, for example, strategy selection and decision about making concessions and their size.

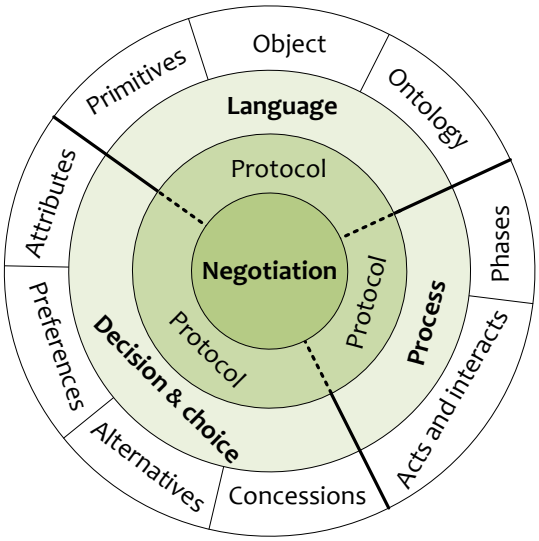


Fig. 5 Three negotiation protocols and their key constructs (adapted from Muller 1996, p. 213)

*Process* refers to the structure or model of the negotiation process which focuses on the joint actions and interactions of the negotiators but which may also include their individual actions.

*Language* refers to the terms which are used to describe information; its purpose is to formulate the communication content. In face-to-face negotiation the language may be informal and the communiqué's meaning may not be clear so that the negotiators spend much time in clarifying the intended message. In e-negotiations and especially in negotiations conducted by and with software agents, the language has to be well structured and unambiguous.

The negotiation language *primitives* are terms which indicate the state and/or action; for example, propose, request, answer, and refuse. The *object structure* is the configuration of primitives used to describe a negotiation concept, such as, act, offer, rejection and request. *Ontology* (or taxonomy if ontology is not available) is used to formulate meaningful statements

from primitives and objects.

Ontology may describe the domain of the subject of the negotiation, for example, it may be a comprehensive description of air pollution together with the possible remedies. This description includes the entities that cause and reduce pollution, the pollutants, their properties such as intensity of pollution, usage and costs, and the relationships among the entities. In such a case it can be used as domain knowledge, helping the negotiators to understand and formulate the problem, construct and analyze solutions, and also to formulate messages and understand the messages sent by others who also use the same ontology.

The distinction between ontology and knowledge is important albeit in practice we must have a little (or more than a little) of both: we have to know the negotiation subject and we must know something about the process and its possible results. It is important, because a negotiation ontology can cover everything that pertains to the negotiation process, activities, strategies, offers, concessions and so on. If we have such an ontology, then its positioning in Figure 21-5 would be incorrect. This comprehensive knowledge of negotiation would include every possible negotiation protocol.

The construction of a negotiation and other ontologies has been undertaken in the multi-agent system (MAS) community. Ontology can provide the general framework for software agents to engage in negotiations and reach an agreement. The agents can use it to view and compare protocols that are implemented in this ontology and decide on one that best fits the particular type of negotiation they need to conduct (Tamma, Phelps et al. 2005).

The construction of a negotiation ontology is a large and difficult enterprise. Several ontologies have been proposed but they are very narrow in scope and applicable for research and testing of software agents' behavior (Dong, Hussain et al. 2008).

The partial taxonomy, which we discuss here, indicates the scope of such an endeavor and its difficulty. A possible approach is to do it in stages and in a piece-meal fashion. The downside of such an approach revolves around the necessary overlapping of the results, and the introduction of contradictions and redundancies. But in this way we could have one or more taxonomies, small and narrow ontologies which are focused on one or a few negotiation types, and protocols serving different purposes. These results could immediately be tested and compared leading to more comprehensive taxonomies, ontologies and protocols.

Out of necessity researchers and designers take a narrow and focused approach to the construction of taxonomies, ontologies and protocols. This perspective is also reflected in Figure 5; the ontology scope is limited to the content of communication, it helps the users to understand and agree on meaning of terms and messages. There are three separate protocols indicated, each responsible for the organization of the activities associated with the respective category.

# 3. COMMERCIAL SYSTEMS

During the dot.com "revolution" a large number of e-commerce businesses had been established and over several years went bankrupt or were folded into a more successful

company. They included firms that developed and deployed systems on the Web for the purpose of providing negotiation support to consumers and businesses.

The expectations of the founders and investors were, at the turn of the century, enormous. The relative novelty of the Web and its exponentially growing popularity led many to believe that millions if not billions of dollars were to be made if only they were to move quickly. This was the case for quite a number of new multimillionaires and there was a spur of commercial and technological innovations. At the same time, a number of businesses implemented the well known and described processes on internet expecting that e-commerce, or rather "e-everything," would replace commercial and other interactions conducted in all brick-and-mortar and similar venues.

The fight for space on the internet, for being the first with novel and well known socio-economic processes alike, led to a large number of applications. Governments, especially the US and state governments, tried to help their army of inventors in achieving competitive advantage. The 1998 U.S. Court of Appeals for the Federal Circuit ruling that patents could be awarded for business methods led to a flood of patents (the increase was over 6 times higher than the average increases prior 1998), including patents for conflict resolution and negotiation.[4] One result was awarding patents that had no innovation other than performing a sequence of acts with the use of a networked computers rather than face-to-face.

Commercial ENSs are difficult to review unless they are used and their mechanisms are studied in detail. Both may be difficult because some systems are not available, others are very expensive and require a complex set up process. The mechanisms are rarely clearly described arguably due to trade secrets. The marketing materials provided by the companies tend to be hyper-optimistic, especially these developed by the small dot.com firms. The systems are marketed as automatic, intelligent, smart, multi-dimensional and capable of almost anything, when in fact all the system may provide is access to a database and bookkeeping.

## 3.1 Access systems

Access systems provide very limited functionality with their main purpose being to connect people. There are two types of access systems. One type of access systems connects users who wish to resolve conflict, make a complaint and seek retribution to connect to "neutrals" who are experts, mediators and facilitators. The neutrals try to help to resolve the conflict and they may have limited powers in providing compensation. One example of this type of system is SquareTrade which, through a large number of neutrals, provides service dispute resolution services (Raines 2006) for eBay.com.[5]

The other type of access systems is involved with assisting parties to communicate with each other or helping one side to make offers. BravoSolution (owned by Italcementi Group) is providing this type of services.

[4] Business methods cannot be patented in some countries, e.g., Australia, Canada, signatories of the European Union Convention and India.

[5] SquareTrade.com is not affiliated with eBay.com; it (August 10, 2009) provides warranties to customers of every merchant who signs up with it.

These services include "collaboration and consensus tools,… single or multi-step negotiations … what if optimization techniques."[6] The company does not provide any information that would allow the determination of what specifically these tools are doing, what and how negotiations are supported and what the optimization techniques are used for. On the UK local government sourcing web site, the company states "Over 70,000 online negotiations managed, totaling over € 35 billion of spent [and] online negotiations support services available in 20 languages" [7]

Based on the information available in 2006, on-line negotiation services were limited to auctions with support provided by the BravoSolution call-in center which had both telephone and computer connectivity. The buyer, in the procurement case, could observe the auction and the sellers would communicate with the office submitting their bids via computers and telephones.

The bids made by a telephone are entered into the database by the call center so that they are displayed on the auction web page and thus visible by the buyer and those bidders who access internet. This extends the bidders population to those who cannot and do not want to use a computer network. This type of service coupled with training provided by the company may be one reason for a number of EU government agencies giving their suppliers access to BravoSolution (e.g., UK Home Office at https://sourcing.homeoffice.gov.uk, and Ministry of Justice procurement at https://justice.bravosolution.co.uk).

There are also industry specific systems. WideStorm, for example, provides access to, as the company calls it, the "industry first negotiation engine." [8] The company focuses on one market, albeit large, which is car sales. The site requires that both dealers and consumers register with it. The consumer then contacts the dealer through the web site and the negotiation is either done via email or through the online account that the consumer set up upon his registration. The process should be straightforward as there are no other services provided than the redirection of emails.

ChemConnect which is an e-marketplace designed for the petro-chemical industry provided negotiation tools and services for chemical and plastic materials and products.[9] Members of the ChemConnect could post RFQ, offers and use a messaging system. The e-marketplace is no longer operational.

## 3.2 E-negotiation tables

[6] I tried to contact the company and learn more about their services but to no avail; the emails did not go through. Downloaded on August 5 5, 2009 from:
https://www.bravosolution.com/cms/us/solutions/software-suite/sourcing/key-features

[7] Downloaded on August 5, 2009 from: https://www.localgovsourcing.co.uk/web/corporate.htm

[8] http://www.widestrom.com, accessed on August 10, 2009. This assessment is based on comments posted on Driving Revenue Monthly Newsletter, April 2009, www.drivingrevenue.biz.

[9] http://chemconnect.com/102501.html, accessed on August 10, 2009.

E-negotiation tables are virtual meeting spaces where the parties may post offers and messages, which only they and their counterparts can access. This service is provided by organizations which often provide additional services, including matching, mediation, legal and competitive analysis

E-commerce raised interest in the development of systems for on-line auctions and e-negotiations. Most of the early commercial ENSs were single-purpose. TradeAccess (now defunct) provided an e-negotiation table for organizational buyers and sellers, and access to business forms and databases of prospective buyers and sellers. Cybersettle is an online system that supports its users in negotiating single-issue insurance claims. It has a simple conflict resolution mechanism based on expanding offers made by each party of 20%. Similar systems, such as SettlementOnline, DebtResolve and ClickNsettle provided very similar services to Cybersettle but it did not survive the dot.com bust.[10]

The Electronic Courthouse (NovaForum 2000) provided alternative dispute resolution (ADR) services by linking claimants with a roster of lawyers and ADR professionals.

We illustrate e-negotiation tables with the system known as EcommBuilder, which was offered by TradeAccess, founded in 1998. This is perhaps one of the more interesting stories about dot.com firms providing negotiation services. TradeAccess, changed its name to Ozro in 2001, went bankrupt, and finally turned into a shell company named Sky Technologies (owned by the former Ozro CEO). TradeAccess patented several inventions, such as conducting "multivariate negotiations over a network," "ordering sample quantities over a network," "automated, iterative development negotiations" and "updating user-supplied context for negotiation over the internet" (described in the US Patents 6,141,653; 6,332,135; 7,194,442; and 6,338,050 respectively). These patents allowed Sky Technologies to be able to sue one developer after another of enterprise planning and supply chain management software (e.g., IBM, Ariba, SAP and Oracle), in 2005 and later.

The EcommBuilder software is an example of an e-negotiation table oriented towards purchasing negotiation with an easy to navigate interface and structured process for bilateral negotiation. TradeAccess proposed to maintain a database of qualified buyers and sellers who presumably would pay for being listed. Because the system could be used in purchasing across national borders, its users would be able to use contract forms and access lawyers in different jurisdictions.

The purchasing negotiation process follows the following three phases (using the buyer's perspective):

1. Formulation and submission of a request for quotation (rfq) and selection of the potential sellers from the TradeAccess';
2. Sellers' assessment of the rfq, negotiations; and
3. Purchase order submission.

In the first phase the buyer may search through the database of components and firms that sell these components. If one or more firms are identified, then the buyer may contact them

[10] The web site settlementonline.com, which had been used by the company in the early 2000, is, as of August 5, 2009, a page with links to insurance, law and other firms.

via the system, thus moving to the next phase. Alternatively, the buyer may prepare a document with a request and upload it to the system. In order to maintain consistency and make a database search possible, EcommBuilder required users to fill in such fields as quantity and description of the product, standard trade term, delivery term, payment method and banking information.

Following the submission of the RFQ the system notifies the selected suppliers by email with a link to the relevant account. If there are no suppliers selected, EcommBuilder searches the supplier database. It may happen that there are no suppliers stored in the database that can provide the requested product, in that case the user has to identify them. Once a supplier is notified and accepts the RFQ, she enters the TradeAccess website and fills in a form which is the negotiation document (Figure 6).[11]

The RFQ form, that is, the form shown in Figure 6 and another form with information on the seller delivery terms and banking information, are stored on the web site and the buyer is notified via email. The seller may also add a free text note and attach documents. The buyer reads the offer (i.e., the two forms) and may propose a counteroffer. The restriction imposed by the system is that the two sides cannot negotiate on the same issues; the seller can propose discount and unit price values and the buyer the quantity. This can be seen in Figure 7, in which the quantity of the first product (Retainer) is changed from the initial 24,200 (Figure 21-6) to 50,000.

The only way for a party to request a change in the issue values to which the system gives control the other party is with the use of a free-text message. This is shown in Figure 8; the buyer wrote a message in which he stated that he changed the quantity to 50,000 but expects a change in the discount from 2% to 3%. The buyer also requested changes in the delivery time which are entered in a separate form.

[11] The screenshots are modified so that they do not take a lot of space but illustrate the process as it was presented on the TradeAccess web site in August 2000.

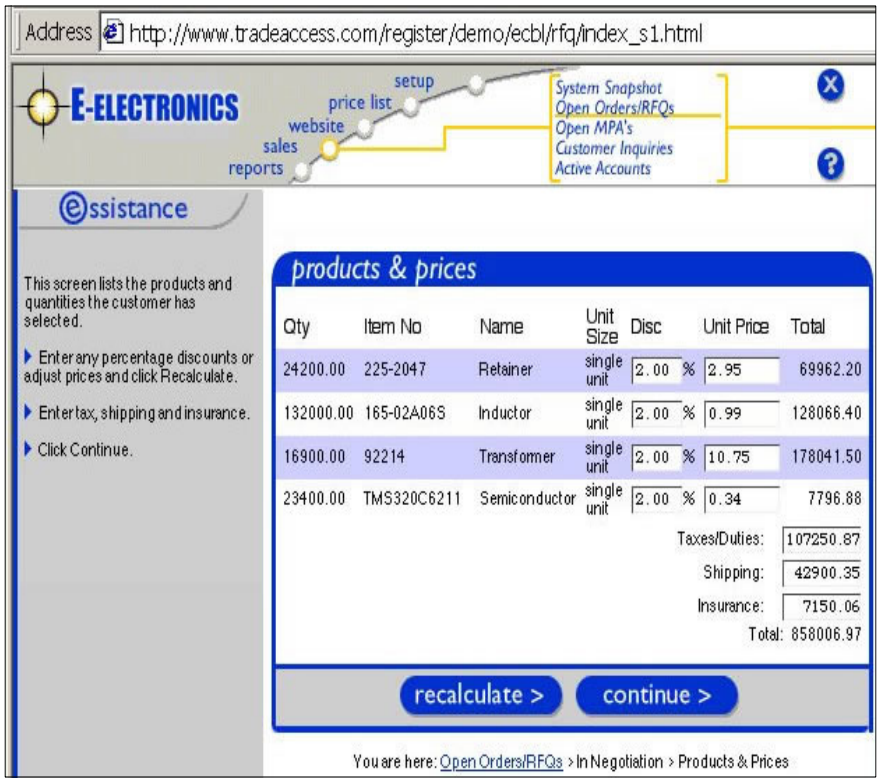


Fig. 6 Example of EcommBuilder's buyer negotiation form


**F**ig. 7 Example of EcommBuilder's seller negotiation form

The parties enter the third, concluding phase, once they accept the terms. This allows the system to generate a standard purchase order document.

TradeAccess prepared a series of screenshots illustrating the negotiation process. Because of their promotional and marketing character, it is natural to assume that they describe the system functionality. Reviewing these screenshots, the limitations and simplicity of the system becomes clear even for an early ecommerce application. For example, the EcommBuilder system has small subset functionalities of the simple teaching and research-oriented systems (discussed below), such as Inspire, **INSS** and **ICANS** developed three and more years earlier. This would not be an issue worth raising if not for the claims regarding the system features like

automated negotiations and enhancement of commercial relationships and patents.

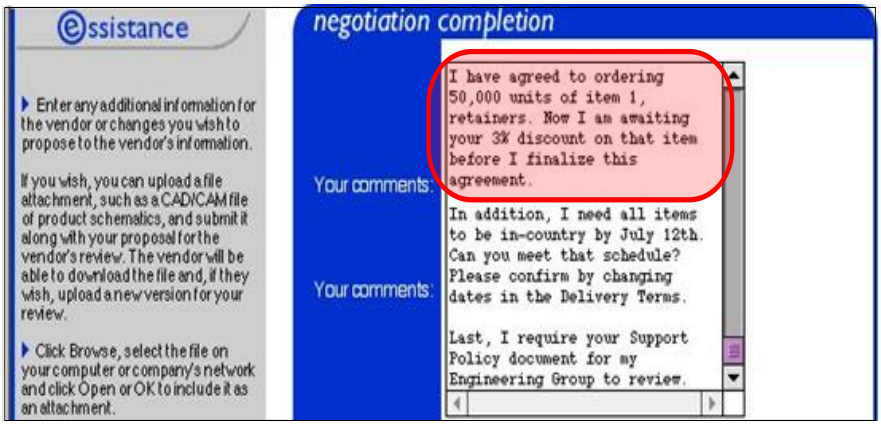


Fig. 8 EcommBuilder's message box used to request a concession

Interesting results were seen in the Sky Technologies' series of patent infringement cases. The cases were settled out of court and suits dismissed with Sky receiving millions of dollars. For example, in January 2008, Ariba agreed to pay Sky $5.5 million and $400 thousand to cover Sky's expenses. This amount may be high for many of us, but is quite small for large corporations that pay tens of millions of dollars in legal costs. Incurring an expense of several million may be a prudent business decision, if it is compared with the costs of the continuation of a trial and the possible appeal that may cost well over ten million.[12]

## 3.3 Negotiation support

E-negotiation tables facilitate negotiations conducted by remote parties. The main sources for facilitation are: (1) the use of databases and associated with it security and storage; and (2) provision of forms that the user may fill in and sent to the other party. Commercial **ENS** that provided decision and negotiation support in addition to facilitation had similar difficulties as the firms discussed above.

SmartSettle, formerly One Accord, is a commercial system which is an extended and partially ported on the Web version of a research system ICAN (Thiessen and Loucks 1994; Thiessen, Loucks et al. 1998). It is one of a few stand-alone systems that continue to offer services in 2009. The system differs from other systems discussed here in that its use requires the participation of **ICAN** facilitators. This business model is different, than CyberSettle, which aims at similar market segments, because the facilitators are involved from the outset. That is they are involved during the problem formulation, which is prior the actual negotiation begin. ICAN does not offer software as a service in the marketplace; instead, it focuses on providing both people and software service for the purpose of conflict and dispute resolution.

[12] To illustrate the size of the possible legal and accounting expenses a company may incur, consider the recent agreement between General Electrics and Securities and Exchange Commission in which GE agreed to pay fines of $50 million, a quarter of $200 million it paid inn legal and accounting fees to deal with charges ("Magic Numbers", *The Economist*, August 8, 2009).

We illustrate ens-based support with MarketProwess, which was designed by BiosGroup to support business transactions. BiosGroup, a spin off of the Santa Fe Insitute, was founded in 1997 with the purpose of commercializing scientific software for business and management.

The software supported the search and selection of potential negotiation partners based on multiple attributes. The user was requested to specify the product and its relevant attributes. For each attribute he could give three values: minimum, maximum and the most preferred. The example shown in Figure 9 lists five attributes and attribute quantity has the range of acceptable values [1,000; 2,000] with 1,500 units being the preferred number. The buyer could also provide the preferred suppliers; three are listed in this figure.

MarketProwess searched the marketplace and displayed companies that matched the specified attribute ranges or values. Figure 10 shows the results of such a search. The software identified sellers and buyers who requested products within the specified range of values for attributes: performance, time of delivery, financing terms and quantity, and the acceptable values for the customization attribute.

The minimum and maximum bounds imposed on the attribute values are hard constraints. Given these constraints and the user's preferences, the system could display the relationship between two selected attributes and the utility value.

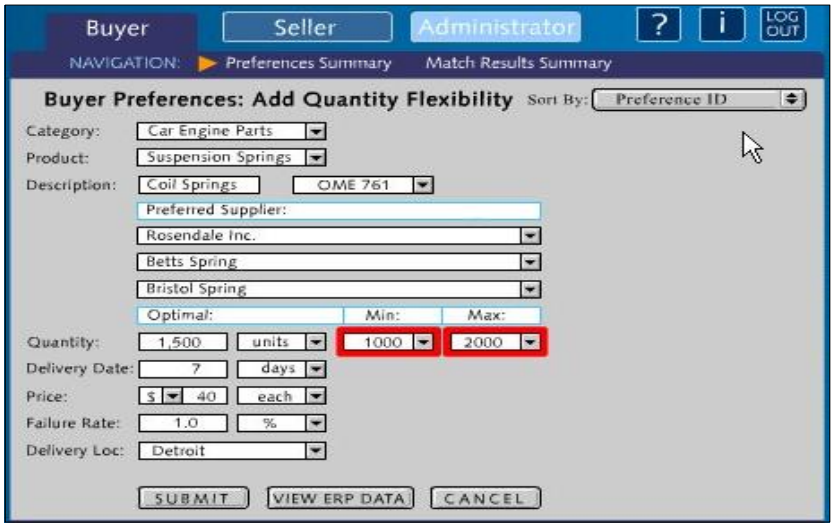


Fig. 9 MarketProwess' product and supplier information panel


Fig. 10 Using MarketProwess to match buyers and sellers

The graph presented in Figure 11, illustrates the relationship between the number of units, time of delivery and utility for the three preferred suppliers which the user entered earlier (Figure 9). For each supplier the relationship between time and volume (i.e., no. of units) is presented as a line (continues and dashed) on the plane defined by these two attributes. The cone reaching up shows the changes in the utility values.

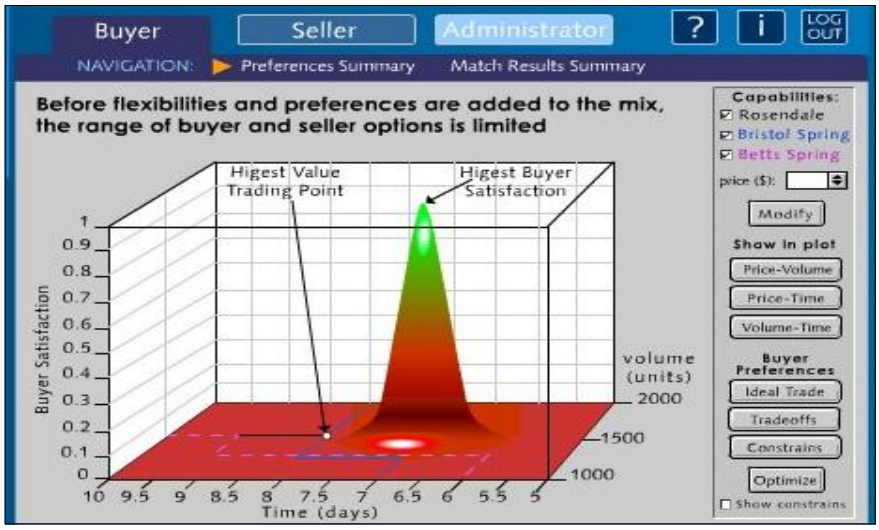


Fig. 11 Attribute and utility values analysis with MarketProwess

The contract selected on the price only is indicated in Figure 9; it is the "highest value trading point." It can be seen that the buyer's utility value for this contract is very low. If the buyer's preferences for all attributes are taken into account, then the best contract is different from the lowest-price contract; it is the contract corresponding to the point "highest buyer

satisfaction".

The panel on the right-hand side of the screen shown in Figure 11 has buttons used for the evaluation of the feasible contract set and the sensitivity analysis. At the top, there are three selected suppliers and an entry box that allows making a change in the price value. Below are three options for the graph display. In this example, the user specified three attributes (price, volume and time), for each combination of two attributes the system generates a graph showing how their values impact the utility. The buyer may also change his preferences, enter trade-off values between attributes directly, and formulate constraints for one or more attributes. Finally, the system may search for the optimal contract, that is, the combination of attribute values that, given all the constraints, yields the highest utility value.

The system has quite advanced graphical capabilities which are used to produce charts thus allowing users to compare the offers made by different trading partners. In Figure 12 offers made by three sellers are compared. On the left-hand side of the screen, the highest utility (satisfaction) for each of the three attributes is displayed. The first supplier (Rosendale) offers lowest costs, the second supplier—made the best offer in terms of quantity and the third supplier—in terms of delivery time.


Fig. 12 Offer comparison

The chart on the right-hand side in Figure 12 shows the total costs per units that are calculated for each offer. The costs are: direct material (also displayed on the left-hand side of the screen), in-bound transportation, inventory carrying, and testing. Although the first supplier offered lowest direct costs, when the additional costs are calculated, the offer made by the third supplier (Bristol) has the lowest overall unit costs.

MarketProwess was positioned as a complementary solution to the enterprise resource planning (ERP) and supply chain management (SCM) software provided by as i2, Ariba,

Commerce One and Oracle.[13] The software was not adopted by a sufficient number of customers; one reason may be that the firms that developed ERP and SCE software began providing auction and negotiation functionalities in their platforms.

# 4. TEACHING AND RESEARCH SYSTEMS

## 4.1 Negotiation tables

SimpleNS (http://invite.concordia.ca/simplens/, has been developed to conduct comparative studies on the use and effectiveness of different ENSs. It provides a virtual negotiation table allowing its users to exchange offers and messages.

The system displays the negotiation case and other information required to conduct the negotiation, presents a form in which users write messages and offers, and shows the negotiation history in which all messages and offers are displayed in one table together with the time when they were made.

The WebNS system is a facilitator supported ENS (Yuan, Rose et al. 1998; Yuan 2001). It focuses on process support, in particular on structuring of text-based exchanges and automatic process documentation. The system implements two negotiation phases based on Gulliver's descriptive model (1979). The two phases are: preparation and offer exchange.

Negotiation preparation is supported with tools such as a session description and private notes. The main support of WebNS is in the conduct of negotiations. The system uses real-time chat and video conferencing to exchange offers and counter-offers as well as short messages. The protocol underlying WebNS treats every issue separately and, hence, does not explicitly support the discussion of tradeoffs among issues.

WebNS supports the specification of, and discussion about, issues. The focus on the process can also be seen in the implementation of the sequential negotiation approach. This approach is often used in real-life negotiation due to the cognitive difficulty in the negotiators' simultaneous discussion of several issues and their options.

In WebNS each issue is separately discussed and the information is displayed in the window containing the user messages or in the window with the counterpart's messages. A screenshot with seven windows designed for different types of activities is shown in Figure 13.

When the parties reach an agreement about an issue the agreement is displayed in the 'common' window shown at the bottom and left-hand-side of Figure 13. An interesting feature of WebNS is the possibility of introducing a facilitator or advisor into the process. The advisor monitors the exchanges and establishes communication with one party; a facilitator interacts with, and provides advice to, both parties.

[13] Downloaded from the E-optimization Community web site on August 5, 2009
http://www.e-optimization.com/solutions/solution.cfm?id=102#document

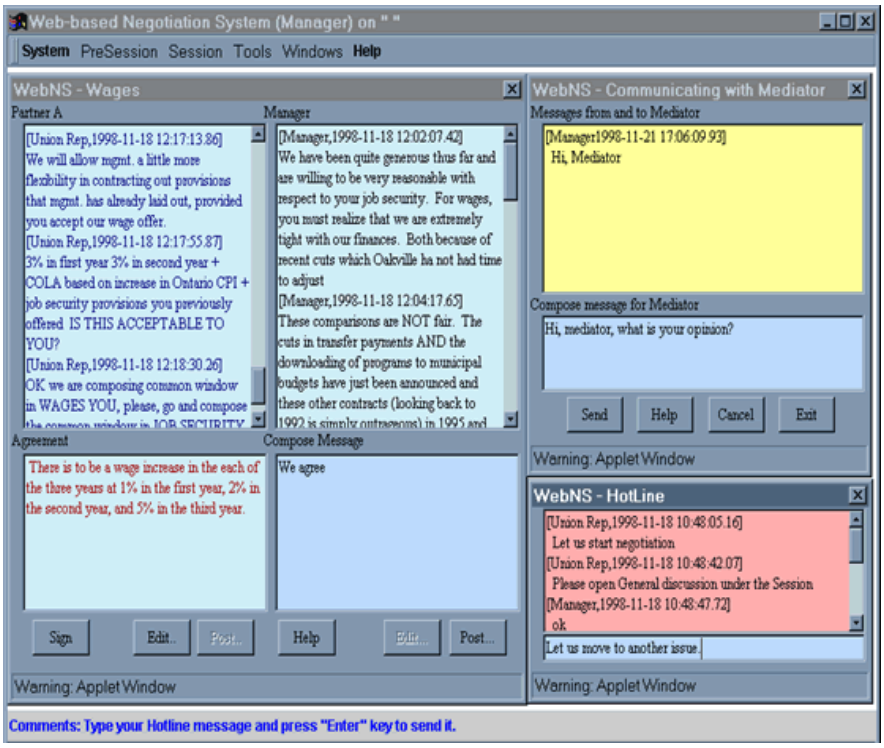


Fig. 13 Issue discussion window (left); consulting window (up-right); and hot line (bottom right)

## 4.2 Support for e-negotiation

The Web-HIPRE system provides user-oriented support. It is an experimental decision support system used for research and training purposes (Mustajoki and Hämäläinen 2000). The system's focus is on the formulation and evaluation of the user's preference structure, construction of the utility function and ranking of decision alternatives. Users may employ several sensitivity analysis tools to assess the impact of their preference structure on the ranking of the alternatives.

Web-HIPRE requires that decision alternatives are either earlier specified or entered by the user. In addition, users need to specify criteria which are used to assess the alternatives and also their levels for each alternative. The difficulty of the problem is not in complex relationships between objective functions, constraints and variables, and interactions between models describing components of the overall problem, but in the subjective and unspecified preference structure and its impact on the choice of an alternative.

Another system is Negoisst which evolved a process-oriented system (Schoop, Jertila et al. 2003) to an integrated system with document-management (Schoop, Jertila et al. 2003) and decision support capabilities (Schoop, Kohne et al. 2004). The system imposes a partial structure on the negotiated contract (document) to allow its versioning according to the contract clauses, their authorship and time.

We illustrate this type of ENS systems with Inspire, which was developed in 1995 and since 1996 it has been used to conduct anonymous bilateral negotiations (Kersten and Noronha 1999).

The system implements a three phase-model of negotiations: pre-negotiation, negotiation, and post-settlement (Figure 14). In the pre-negotiation phase the users analyze the case and specify their preferences. During the negotiation phase the system provides utility values of decision alternatives considered by the user and offers submitted by both parties. The post-settlement phase is used if the parties achieve an inefficient compromise; the system presents up to five efficient alternatives and the negotiators may continue their negotiation until they reach an efficient compromise.

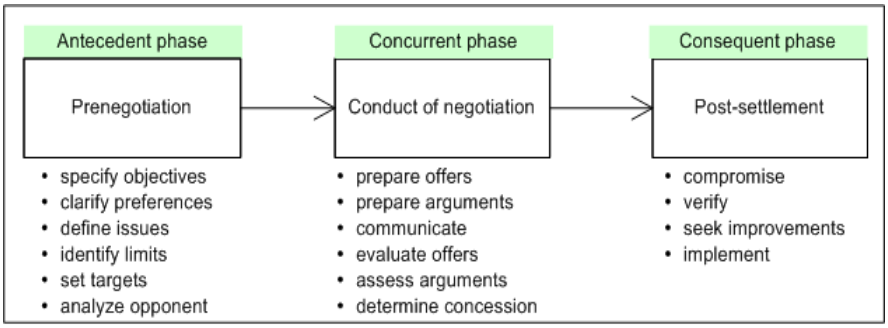


Fig. 14 Negotiation phases and activities supported with Inspire (Kersten and Lo 2003)

Inspire users begin their negotiations by reading the case description. They are provided with information about the side they are asked to represent. After reading the case the users are requested to complete the pre-negotiation questionnaire in which, among other things, they specify the expected outcome and the worst acceptable offer. Subsequently, they are asked to decide about their preferences. They rate issues, issue options and packages (alternatives) by filling in simple tables, and verifying ratings of system-selected offers.

Negotiation preparation leads to the offer construction activity shown in Figure 15. There are two parts to an offer construction: a table in which issues and options are given (options are drop-down lists) and a box in which the user can write a message. The user selects the value for each issue and the system gives the utility value (rating) for the package. Users may compare this rating with ratings of the preceding offers. Verbal messages allow the negotiators to use different pressure tactics to influence their counterparts' decisions and "wrinkle out" any outstanding issues. The negotiators may also use a separate form to send a message which is not related to any offer.

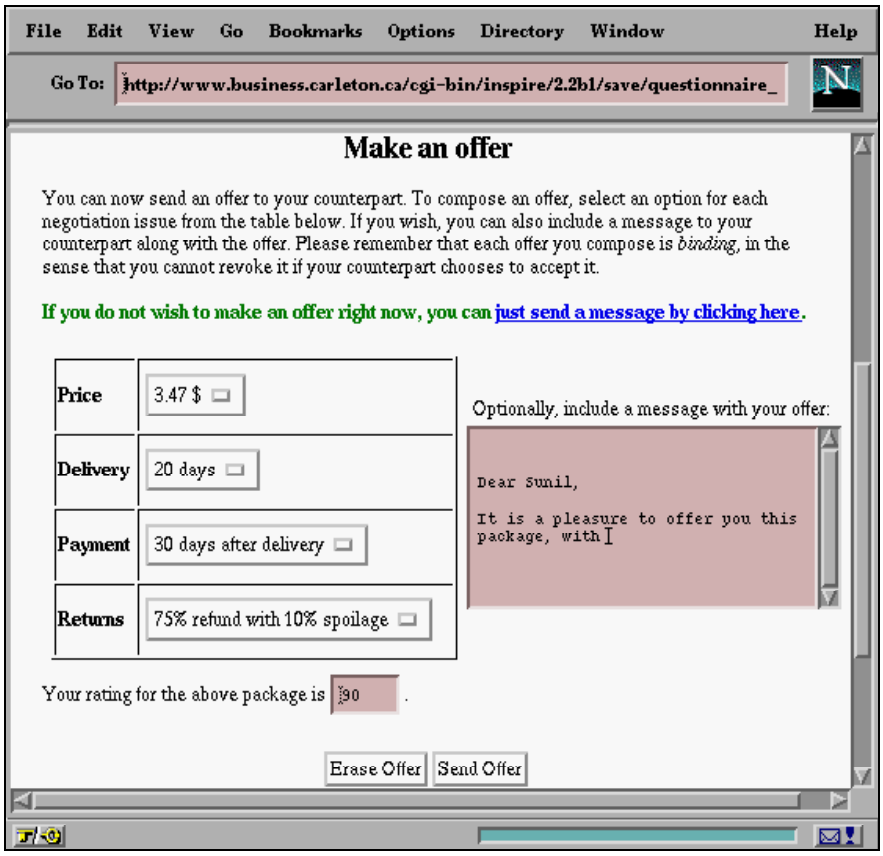


Fig. 15 Offer formulation screen (ca. 1996)

During the negotiation the participants can check the history of offers and counter offers and refer to a graphical representation of the history of offer exchanges (Figure 21-16). The graph presents process information to both parties in a symmetric manner. Each party can see only their own ratings (utilities) and the color-coding is uniform: green for the supported user and red for the opponent. The graph presents the negotiation dynamics in each user's utility (rating) space.

The Inspire system has been used in teaching and training. The use of the system is free providing that the users agree to fill in two questionnaires and that the developers can use the information they exchange for research purposes. A number of results have been published [Kersten, 2003 #648;Kersten, 2003 #608;Kersten, 2003 #642;Koeszegi, 2004 #586;Koeszegi, 2006 #460;Vetschera, 2006 #574;Weber, 2006 #762;Vetschera, 2006 #1183;Vetschera, 2006 #215].

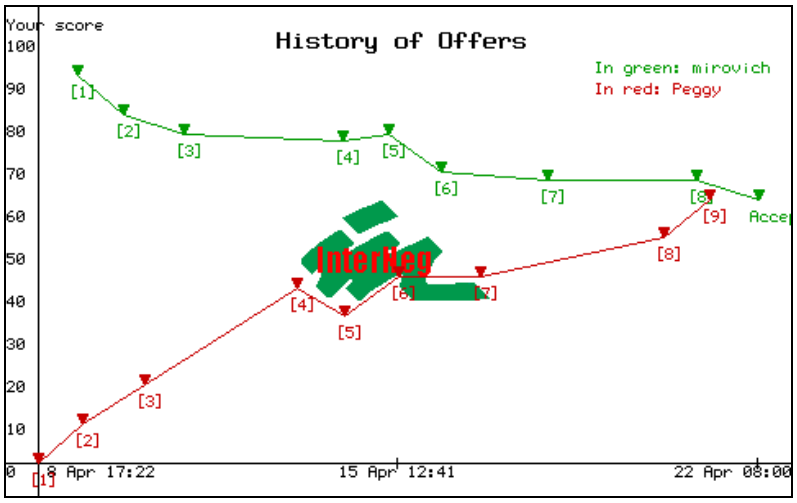


Fig. 16 History graph in "mirovich" utility space

## 4.3 Software platforms for e-negotiations

ENS platforms are designed to integrate various services that negotiators may require. They are capable of running different types of negotiations, for example, bilateral, multilateral and multi-bilateral, with single and multiple issues, and with alternatives specified explicitly or computed from a model. They can provide services that can be customized to the requirements and preferences of their user. They also allow their users to choose between different communication modes, preference elicitation procedures and utility construction models, strategies and tactics, and between different mechanisms such as mediation, arbitration and auction. For team negotiations ENS platforms can provide communication facilities and dedicated support tools for intra- and inter-group activities. Examples of such platforms include auction-oriented SilkRoad (2003) and Invite which allow generation of both auction and negotiation systems based on predefined negotiation protocols (Kersten and Lai 2007).

The Invite platform is an example of e-negotiation system engineering. It is based on a three--tier software architecture built on a Fusebox framework, which enables the model-view-controller (MVC) design. The three types of components and their main subcomponents implemented in Invite are depicted in Figure 17.

The Invite platform was designed to allow the execution of different negotiation processes defined by protocols. It also allows for the parties to follow different protocols; in effect each party may have different abilities determined by this party's protocol.

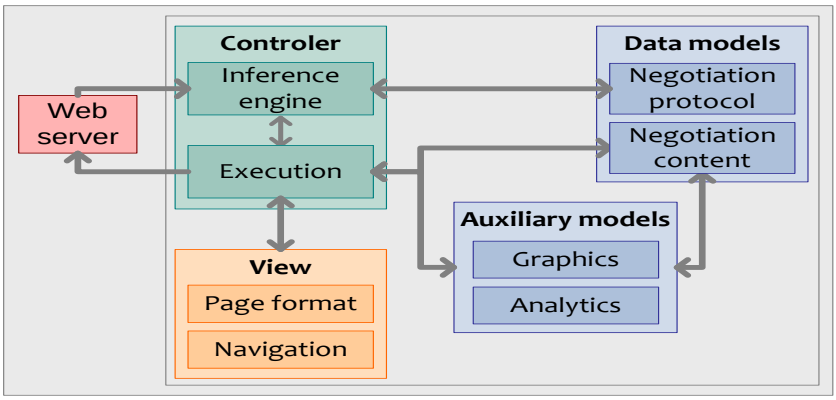


Fig. 17 Overview of the Invite platform architecture

We designed protocols for several negotiation types and the components that implement all required negotiation activities for these negotiations. The protocols are used to generate an ENS capable of supporting particular negotiation activities. Because of the separation of the view component and the protocol, it is possible to construct the same mechanism (model and controller) for different interfaces. Example of six similar layouts for different e-negotiation and auction systems is presented in Figure 18.

A similar-looking interface layout is used for every system in order to minimize the impact of the distinct interface features on the negotiators' performance and to compare the use and usefulness of each system and its role in the negotiation process. The six screen shots presented in Figure 18 come from different ENSs generated by the Invite platform. The first four belong to systems supporting bilateral negotiations (SimpleNS, Inspire$^-$, Inspire and INSS) and the last two to multi-bilateral negotiations (Imbins and InAction).

We conducted ten sessions of laboratory experiments using the Inspire$^-$ and Inspire systems implemented using the Invite platform. The total number of participants was 114, mostly graduate and undergraduate students majoring in business and engineering. Each session allowed for the maximum of one hour of negotiation. No training on how to use the system was offered before the start of negotiation. In all negotiations, we observed active exchange of offers and messages.

Out of 57 bilateral negotiations, 41 agreements were reached. No difficulties in using the system were reported by users. Most questions raised by the participants during the negotiation session were related to the negotiation case and the preference elicitation model. We believe these results indicate that the framework not only allows reduced context dependency but also to develop ENSs with a high degree of usability.

Based on the available components implemented in the Inspire system, two other systems were designed for the comparative studies of auction and negotiation systems. One of them, Imbins, (InterNeg multi-bilateral integrative negotiation system), is a system that extends the current bilateral negotiation to multi-bilateral cases. The second system is InAuction (InterNeg auction system), which supports a limited-information multi-attribute English auction. These two systems are built with similar user interfaces, functions, and architecture (Figure 18).

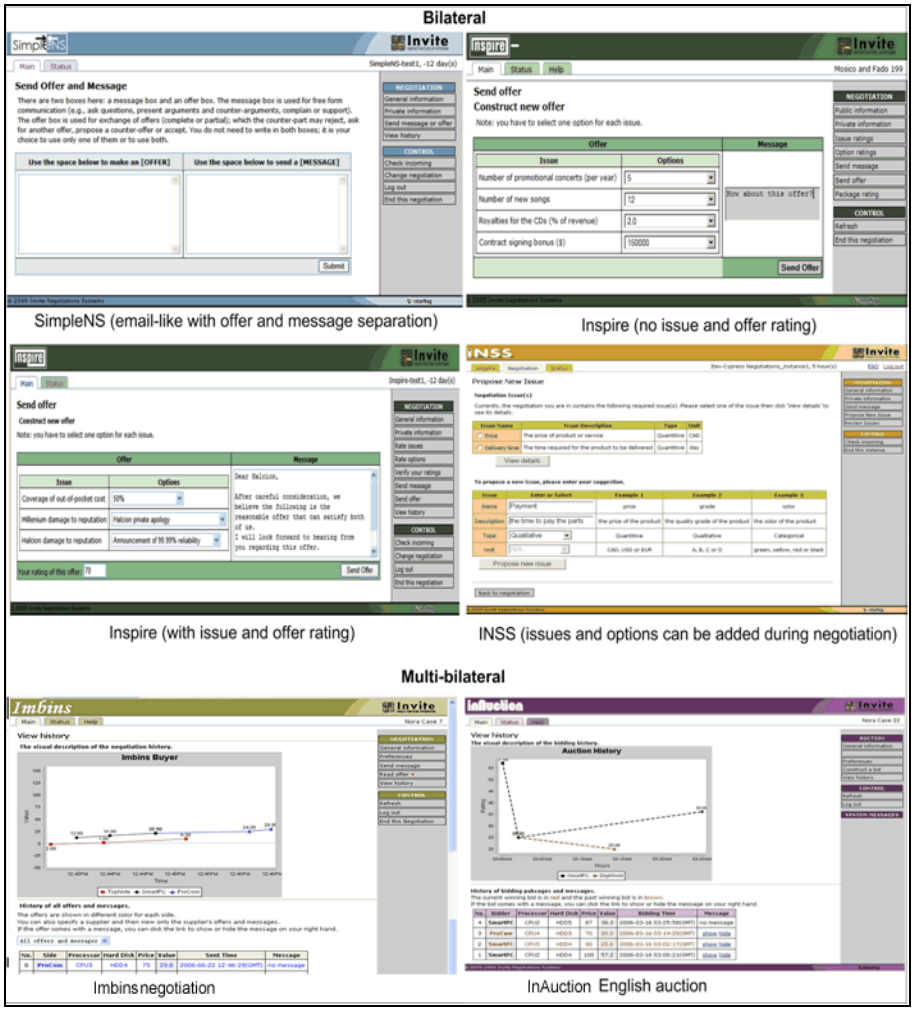


Fig. 18 Screenshots of six Invite ENSs generated by different protocols.

# 5. E-NEGOTIATION RESEARCH

E-negotiation systems have been introduced in early 1980s, to study the use and usefulness of the software and the behavior of its users. Initially the studies had been undertaken as part of the management sciences and information systems research agenda. Over the years the systems became more sophisticated in terms of their scope and depth of support.

The widespread use of email and internet led behavioral researchers to become interested in negotiations conducted using email, via video, and groupware systems. These studies typically focused on the exchange of written and spoken messages rather than decision and negotiation support.

## 5.1 Research findings

The definition of ENS formulated in Section 1.1 is deliberately broad to allow for the inclusion of system types widely used in negotiations. These systems are various email servers and clients and their wide spread use led to studies on negotiations via email (see e.g., Croson 1999; Thompson and Nadler 2002).

Experimental studies of email negotiation resulted in three types of observations: (1) the need to increase communication bandwidth; (2) the impact of non-task related activities on the process and outcomes, and (3) the potential of support tools. Narrow communication bandwidth and the non-task related activities are of particular importance for negotiators who need to establish rapport, trust and reduce the social-distance with the other party, and who employ positive or negative emotional style as opposed to the rational style. Email negotiations contribute to more equitable outcomes than face-to-face negotiations and increase the exchange of multi-issue offers, but they require more time and more often result in an impasse. This indicates that asynchronous exchanges allow for reflection and consideration of several issues simultaneously rather than sequentially. It also shows the need for: (1) support to increase process efficiency; (2) search for alternative offers; and (3) the provision of facilitation and mediation.

The communication bandwidth and the richness of media used in e-negotiations affect the process and its outcomes. However, the experimental results are mixed because of the use of different systems and tasks. Purdy and Nye (2000) conducted experiments where negotiations via a chat system were compared with face-to-face, video and telephone negotiations. They found that, in comparison with people who negotiated face-to-face, chat users were less inclined to cooperate, more inclined to compete, needed more time to reach an agreement, negotiated a lower joint profit, were less satisfied and had a lower desire for future negotiations. Interestingly, telephone and video conferencing produced mixed result; in some cases one medium was better than chat but another medium was worse, in others it was vice versa. Although chat and email have the same communication bandwidth, the results observed are quite different, possibly due to media (a)synchronicity. This comparison illustrates the difficulty in making conclusions regarding the relationship between media richness and social interactions. We should note that email and chat systems do not provide any decision and negotiation support and their communication support is limited to exchanges of text and storage of unformatted transcripts. This may be one reason for the negative impact of chat on negotiations.

Yuan, Rose et al. (2003) conducted experiments using the WebNS system which provides process-oriented support, including organization of exchanges, formatting of text and alerting. They report that users prefer text with audio or video communication to text alone. They also observe that the addition of video to text and audio communication in a negotiation environment was not found to be beneficial.

Weber, Kersten et al. (2006) conducted experiments using two versions of the Inspire system: with and without graphical support. No difference was observed in the proportion of dyads that reached agreement with graphical representation compared to the system without graphical support. For dyads that reached agreement, participants using the system without

graphical support submitted a lower number of offers. The average message size per dyad was 334 words greater, on average, for successful negotiations without graphical support. The incongruence between the information presentation format and the negotiation task is thought to require more extensive textual explanation of positional and offer rationalization to compensate for the lack of graphical support.

Data obtained from negotiations via Inspire was also used to study the relationships between user characteristics and the use of different features of the system, and the reasons for the underlying differences in the negotiation processes and the achieved outcomes. The results of the analysis of the Inspire data show that user characteristics (in particular previous negotiation experience), the use of the internet and the user's culture influence perceptions of usefulness, ease of use, and the actual use of the system (Köszegi, Vetschera et al. 2002). Previous negotiation experience has a positive influence on the perceived ease of use of the system; however, it has a negative influence on the usefulness of its analytical features (Vetschera, Kersten et al. 2006).

Lai, Doong et al. (2006) studied the influence of cooperative and non-cooperative strategies on e-negotiations and their outcomes. Less cooperative negotiators tend to submit more offers but fewer messages and have less control over the negotiation process than more cooperative negotiators. Cooperative negotiators view the process as friendlier and are more satisfied with both the agreement and their own performance. The researchers found an association between the negotiators' own strategies and their perceptions about counterparts' strategies and also between the pairs of strategies and final agreements. The proportion of negotiations reaching agreement is larger for the cooperative cluster than for the non-cooperative cluster.

The Aspire system (Kersten and Lo 2003) is one example of a design that addresses the needs of inexperienced negotiators. Aspire is an extension of the Inspire system with a NAA. The agent provides methodological advice during the negotiation. A comparison of e-negotiations showed that the negotiation effectiveness (measured with the percentage of users who achieve agreements) and the users' willingness to improve the compromise is higher in negotiations supported by a NAA. Similar results were obtained by Chen, Kersten et al. (2004).

The use of ENSs, in particular those which provide problem and process support and automate some tasks, depends on their usefulness and ease of use. The experiments which use models of information systems adoption and fit focus on the factors that affect the ENS user intentions regarding system use and usefulness. Vetschera, Kersten et al. (2006) formulate and test the *assessment model of internet systems* (AMIS) which is an extension of the technology acceptance model (TAM) (Davis 1989). The purpose of AMIS is to determine the measures of a web-based system success, based on its actual and reported system use. The model has been validated, and one important result of the analysis is that the communication and analytical tools need be considered separately in the measurement of the system's ease of use and its usefulness.

Lee, Kang et al. (2007) replaced the original TAM model's independent variables with playfulness, causality and subjective norms and showed that these characteristics have a positive effect on the negotiator's intention to use an ENS, through their effect on perceived usefulness. They observe that persons may use an ENS because: (1) they have been persuaded that using it is an enjoyable thing; (2) its use will increase their performance; (3) their

supervisors, peers, or subordinates think they should use an ENS; or (4) because of the causal nature of their negotiation tasks. Turel and Yuan (2007) extend TAM through the inclusion of perception regarding the intentions of the negotiation counterpart to engage in e-negotiations. They found that the counterpart's perceived intentions have a significant positive effect on the persons' acceptance of ENS. Doong and Lai (2007) experiments on the intentions to continue using ENSs indicate that users' experience with ENS exceeding expectation has positive impact on their intentions to use the system.

The acceptance and usage of ENSs depends on the degree of trust the negotiators have towards the system and the services the system can provide. Turel and Yuan (2008) studied the effects of trust in process-oriented ENSs and the role of the system as both a mediator and object of trust. Yang, Zhong et al. (2007) proposed that the users' beliefs toward the system effectiveness and their trust in using the system depends on four constructs: system characteristics, negotiation characteristics, institutional and situational characteristics. They propose a research framework for small and medium enterprises with the intention toward e-negotiation acceptance. These constructs are also included in the framework discussed in the following section. These constructs are also included in the framework discussed in the following section.

## 5.2 ENS research frameworks

Many studies have been conducted on ENS design, development and deployment, e-negotiations and automated negotiations. The increasing use of the internet, the growth of e-business, the emergence of new e-marketplaces and growing interest in using web-based systems for participatory democracy have prompted more, predominantly interdisciplinary studies, undertaken at the juxtaposition of psychology and sociology, information systems and computer science, management and economics, engineering, ethics and anthropology (Bichler, Kersten et al. 2003). New concepts, methods and models are being proposed. Some are studied from the theoretical viewpoint while others are experimentally verified. All these efforts and various perspectives and research paradigms contribute on one hand to the liveliness of the e-negotiation field and, on the other hand, to the need for research frameworks. Such frameworks are necessary in order to study and compare various ENSs, compare different experimental results and to conduct comparative studies in market mechanisms and the use of negotiation models in conflict management.

We are increasingly enmeshed in a variety of socio-technical systems. One may predict that negotiated social systems will also gravitate toward their socio-technical counterparts. One may also expect that this transformation might bring negative along with positive changes, some of which have been mentioned in Section 5.3. In order to identify both types of changes and their underlying causes we need to learn a lot more about negotiators and their interactions with the system and with their counterparts via the system. We also need to learn about the relationships between support and advice from and automation by an ENS and the users' perceptions, trust, rapport and satisfaction.

These and similar efforts require building on the results obtained from the pre-internet era, including the re-evaluation of the research constructs presented in Table 3. We do not aspire here to propose concrete frameworks; rather, we wish to emphasize their need and mention

two ways to construct them. One approach is to use general frameworks and to adapt them to e-negotiations, for example, Lewis and Shakun (1996) propose using Shakun's (1988) *evolutionary systems design* (ESD) in negotiation and e-negotiation systems design and implementation studies.

Development and application of taxonomy to construct comprehensive models of e-negotiation systems and processes is also a promising approach. Ströbel and Weinhardt (2003) proposed the Montreal e-negotiation taxonomy for e-negotiation that focused on economics and technology, rather than the socio-psychological aspects. This taxonomy has been used in system assessment and comparison (Neumann, Benyoucef et al. 2003).

Another example comes from an on-going work on the comparison of auction and negotiation mechanisms in economic and social exchanges (Kersten, Chen et al. 2006). This work is based on the Montreal taxonomy and it involves: (1) specification of mechanisms and ENSs in which these mechanisms are embedded; (2) model development that combines models from information systems (which in turn adopted some socio-psychological models) with models from behavioral economics; and (3) experiments in which the models are verified and where mechanisms are analyzed and compared. Although the proposed model has been only partially validated, we present it here to give one example of efforts in the research framework development.

The TIMES framework is concerned with the interactions of five constructs: *task*, *individual*, *mechanism*, *environment* and *system*. The interaction of these constructs takes place during the e-negotiation process which can be observed and assessed based on the strategies and tactics used and modified, the number of interactions and the time to reach a deadlock or agreement, cognitive effort, etc. The process and its antecedents affect users' perceptions and produce two types of outcomes: behavioral and market (objective). Users' perceptions include system and service assessments (primarily usefulness and ease of use), implemented models, and communication facilities and their richness.

Behavioral outcomes include satisfaction with the process and agreement, trust and relationship, market outcomes are various benefits and individual and joint performance (e.g., price, individual utility, agreement efficiency, distance to Nash solution and social surplus). The TIMES framework is depicted in Figure 19.

Following the task-technology model (Goodhue and Thompson 1995) the TIMES framework also includes construct *fit*. This construct, however, is not well defined because there are many dimensions of fit and, in addition to task and technology (i.e., system and models), fit is affected by the individuals who use technology and the environment (Dishaw, Strong et al. 2002).

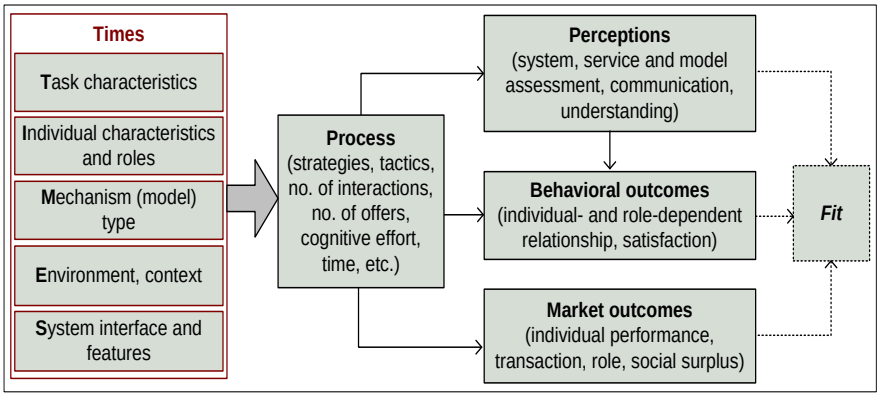


Fig. 19 TIMES framework (adapted from Kersten, Chen et al. 2008)

The primary motivation for developing the TIMES framework was research on electronic exchange mechanisms (e.g., e-markets). However, the model is not limited to studying information systems for conducting market transactions only. It can also be used to study other information systems for which the issues of their ease of use, performance and usefulness are of interest. In this respect, the inclusion of the abstract representation of the underlying "mechanism" in addition to the concrete implementation-specific features would enable studying broad classes of systems. It can also be used in experimental and field research on the relationships between the configurations of the context measures on the process and outcomes measures. Furthermore, it allows expanding the set of measures and including such variables as culture, anonymity, trust and affect.

From the technical aspect, the distinguishing characteristic of ENSs is that they are built with internet technologies and are deployed on the web, which is an open and highly dynamic environment. New technologies are being introduced and quickly become mainstream providing novel solutions and capabilities which negotiation efficacy should study. For example, earlier studies indicated that media and their richness affect negotiators' behavior (Purdy and Neye 2000; Yuan, Head et al. 2003). Web services and other technologies will lead to heterogeneous systems providing ad hoc services requested directly by the negotiators and by their software agents and assistants. We expect that software will have a greater role in the specification of the negotiation procedure thanks to its increasing capability and access to broader and deeper knowledge. This raises questions regarding software pro-activeness in deciding upon the use of communication and support services, the selection of negotiation protocols and the design of the procedure.

# 6. CONCLUSIONS

In this paper, we presented an overview e-negotiation processes, systems and studies. Definitions in literature are sometimes inconsistent or do not allow for a comprehensive categorization of software used for negotiations. In order to establish a shared understanding of the concepts pertinent to the field, we proposed definitions of the different kinds of software used in negotiation facilitation and support. The two key roles that software can play in negotiations and other social processes are passive support and active participation. This led us to make a distinction between social systems and socio-technical systems.

We used the proposed definitions in reviewing systems designed in the past and in discussing system architectures and configurations. The suggested system classification is based on the system activeness, its function in the process and the activities it undertakes.

Internet introduced dramatic changes to the development, proliferation and use of ICTs. These changes affected the ways systems are developed, implemented and used. Therefore, we propose to make a distinction between the two generations of negotiation systems and related research and training: (1) NSSs designed for a stand-alone computer or a local area-network (typically before mid 1990s); and (2) ENSs systems which use internet technologies and are deployed on the web. These two broad categories are discussed from three perspectives: (1) real-life applications, (2) systems used in business, research and training, and (3) research results. Discussion of NSSs allows us to present a comprehensive research framework which proposes measures that have been used in empirical research

The development and applications of enss are driven by new internet technologies and the expanding access to data across the web, use of multimedia, use of software services available on the web, new business models, and so on. Continuously growing e-business, increasing importance of transactions conducted on the e-marketplaces, exchange mechanisms and the related research should be explored from the intrinsic change of both social and technical aspects and the interactive impact between them.

# References

Bichler, M. (2001). *The Future of e-Markets. Multidimensional Market Mechanisms*. Cambridge, Cambridge University Press.

Bichler, M., G. Kersten and S. Strecker (2003). "Towards the Structured Design of Electronic Negotiation Media." *Group Decision and Negotiation* **12**(4): 311-335.

Bjorner, D. (2006). *Software Engineering. Domains, Requirements, and Software Design*. Springer.

Brandl, R., M. Andreoli and S. Castelani (2003). "Ubiquitous negotiation games: a case study." *Database and Expert Systems Applications*, Prague, IEEE.

Cerquides, J., López-Sánchez, A. Reyes-Moro and J. A. Rodríguez-Aguilar (2007). "Enabling Assisted Strategic Negotiations in Actual-world Procurement Scenarios." *Electronic Commerce Research* **7**: 189-220.

Chen, E., G. E. Kersten and R. Vahidov (2004). "Agent-supported Negotiations on E-marketplace." *International Journal of Electronic Business* **3**(1): 28-49.

Chidambaram, L. and B. Jones (1993). "Impact of Communication Medium and Computer Support on Group Perceptions and Performance: A Comparison of Face-to-Face and Dispersed Meetings." *MIS Quarterly* **17**(4): 465-491.

Croson, R. T. (1999). "Look at Me When You Say That: An Electronic Negotiation Simulation." *Simulation and Gaming* **30**(1): 23-37.

Davis, F. D. (1989). "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology." *MIS Quarterly* **13**: 318-340.

DeSanctis, G. and R. B. Gallupe (1987). "A Foundation for the Study of Group Decision Support Systems." *Management Science* **33**(5): 589-609.

Dishaw, M. T., D. M. Strong and D. B. Bandy (2002). "Extending the Task-technology Fit Model with Self-efficacy Constructs." *Eight Americas Conference on Information Systems*, Dallas, TX.

Dong, H., F. K. Hussain and E. Chang (2008). "State of the Art in Negotiation Ontologies for Enhancing Business Intelligence." *4th International Conference on Next Generation Web Services Practices*, Seul, IEEE.

Doong, H.-S. and H. Lai (2007). "Exploring Usage Continuance of E-negotiation SystemsL Expectations and Disconfirmation Approach." *Group Decision and Negotiation*: (in print).

Eden, C. and J. Radford, Eds. (1990). *Tackling Strategic Problems: The Role of Group Decision Support*. Sage, Sage.

Ehtamo, H., R. P. Hämäläinen and V. Koskinen (2004). "An E-learning Module on Negotiation Analysis." *Hawai'i International Conference on System Sciences*, Hawai'i, IEEE Computer Society Press.

Fjermestad, J. and S. R. Hiltz (1999). "An Assessment of Group Support Systems Experimental Research: Methodology and Results." *Journal of Management Information Systems* **15**(3): 7-149.

Fraser, N. M. and K. W. Hipel (1984). *Conflict Analysis: Models and Resolutions*. New York, N.Y., North-Holland.

Goodhue, D. L. and R. L. Thompson (1995). "Task-Technology Fit and Individual Performance." *MIS Quarterly* **19**(2): 213-236.

Gulliver, P. H. (1979). *Disputes and Negotiations: A Cross-Cultural Perspective*. Orlando, FL, Academic Press.

Hiltz, S. R. and M. Turoff (1978). *The Network Nation: Human Communication via Computer*. Reading, MA, Addison-Wesley.

Hobson, C. A. (1999). "E-Negotiations: Creating a Framework for Online Commercial Negotiations." *Negotiation Journal* **15**(3): 201-218.

Holsapple, C. W., H. Lai and A. B. Whinston (1995). "Analysis of Negotiation Support System Research." *Journal of Computer Information Systems* **35**(3): 2-11.

Isermann, H. (1985). "Interactive Group Decision Making by Coalitions." *Interactive Decision Analysis*. M. G. a. A. P. Wierzbicki. Berlin, Springer-Verlag.

Jackson, M. O. (2003). "Mechanism Theory." *Encyclopedia of Life Support Systems*. U. Derigs. Oxford, EOLSS Publishers.

Jennings, N. R., P. Faratin, A. R. Lomuscio, S. Parsons, M. J. Wooldridge and C. Sierra (2001). "Automated Negotiations: Prospects, Methods and Challenges." *Group Decision and Negotiation* **10**(2): 199-215.

Kersten, G. (2002). "The Science and Engineering of E-negotiation: Review of the Emerging Field." Montreal, Concordia University.

Kersten, G. E. (1985). "An Interactive Procedure for Solving Group Decision Problems." *Decision Making with Multiple Objectives*. V. Chankong and Y. Y. Haimes. New-York, Springer Verlag. **242:** 331-344.

Kersten, G. E. (2003). "E-Democracy and Participatory Decision Processes: Lessons from E-Negotiation Experiments." *Journal of Multi-Criteria Decision Analysis* **12**(2-3): 127-143.

Kersten, G. E. (2003). "E-negotiations: towards engineering of technology-based social processes." *Proceedings of the Eleventh European Conference on Information Systems*, Naples.

Kersten, G. E. (2010). *Negotiations and E-negotiations: People, Models, and Systems*. New York, Springer.

Kersten, G. E., E. Chen, D. Neumann, R. Vahidov and C. Weinhardt (2006). "On Comparison of Mechanisms of Economic and Social Exchanges: The Times Model ". *Dagstuhl-Seminar: Negotiation and Market Engineering*, Schloss Dagstuhl, Germany.

Kersten, G. E., E. Chen, D. Neumann, R. Vahidov and C. Weinhardt (2008). "On Comparison of Mechanisms of Economic and Social Exchanges: The Times Model." *Negotiation, Auction and Market Engineering*. H. Gimpel, N. Jennings, G. E. Kersten, A. Ockenfels and C. Weinhardt. Haidelberg, Springer.

Kersten, G. E., S. Köszegi and R. Vetschera (2003). "The Effects of Culture in Computer-Mediated Negotiations: Experiments in 10 Countries." *Journal of Information Technology Theory and Application (JITTA)* **5**(2): in print.

Kersten, G. E. and H. Lai (2007). "Negotiation Support and E-negotiation Systems." *Handbook on Decision Support Systems*. F. Burstein and C. W. Holsapple, Springer. **Berlin:** 133-172.

Kersten, G. E. and H. Lai (2007). "Negotiation Support and E-negotiation Systems: An Overview." *Group Decision and Negotiation* **16**(6): 553-586.

Kersten, G. E. and H. Lai (2007). "Satisfiability and Completeness of Protocols for Electronic Negotiations." *European Journal of Operational Research* **180**(2): 922-937.

Kersten, G. E. and G. Lo (2003). "Aspire: Integration of Negotiation Support System and Software Agents for E-Business Negotiation." *International Journal of Internet and Enterprise Management* **1**(3): 293-315.

Kersten, G. E. and S. J. Noronha (1999). "WWW-based Negotiation Support: Design, Implementation, and Use." *Decision Support Systems* **25**: 135-154.

Kersten, G. E. and G. Zhang. (2003). "Mining Inspire Data for the Determinants of Successful Internet Negotiations." *Central European Journal of Operational Research* **11**(3): 297-316.

Koeszegi, S., R. Vetschera and G. E. Kersten (2004). "Cultural Influences on the Use and Perception of Internet-based NSS - An Exploratory Analysis." *International Negotiations Journal* **9**(1): 79-109.

Koeszegi, S. T., K. J. Srnka and E.-M. Pesendorfer (2006). "Electronic Negotiations – A Comparison of Different Support Systems." *Die Betriebswirtschaft* **66**(4): 441-463.

Köszegi, S., R. Vetschera and G. E. Kersten (2002). "Cultural Influences on the Use and Perception of Internet-based NSS - An Exploratory Analysis." *International Negotiations Journal* **9**(1): 79-109.

Kurrer, K.-K. (2006). *The History of the Theory of Structures*. Ernst & Sons.

Lai, H. (1989). "A Theoretical Basis for Negotiation Support Systems." Krannert School of Management. West Lafayette, Purdue University.

Lai, H., H.-S. Doong, C.-C. Kao and G. E. Kersten (2006). "Understanding Behavior and Perception of Negotiators from Their Strategies." *Group Decision and Negotiation* **15**(5): 429-447.

Lee, K. C., I. Kang and J. S. Kim (2007). "Exploring the User Interface of Negotiation Support Systems from the User Acceptance Perspective." *Computers in Human Behavior* **23**(1): 220-239.

Lempereur, A. (2004). "Updating Negotiation Teaching Through The Use of Multimedia Tolls." *International Negotiations Journal* **9**(1): (to appear).

Lewis, L. F. (1987). "A Decision Support System for Face-to-face Groups." *Journal of Information Science* **13**(4): 211-219.

Lewis, L. F. and M. F. Shakun (1996). "Using a Group Support System to Implement Evolutionary Systems Design." *Group Decision and Negotiation* **5**(4-6): 319-337.

Lim, L.-H. and I. Benbasat (1992). "A Theoretical Perspective of Negotiation Support Systems." *Journal of Management Information Systems* **9**: 27-44.

Lo, G. and G. E. Kersten (1999). "Negotiation in Electronic Commerce: Integrating Negotiation Support and Software Agent Technologies." *Proceedings of the 5th Annual Atlantic Canadian Operational Research Society Conference*, Halifax, NS.

Lomuscio, A. R., M. Wooldridge and N. R. Jennings (2001). "A Classification Scheme for Negotiation in Electronic Commerce." *Agent-Mediated Electronic Commerce: A European Perspective*. F. Dignum and C. Sierra, Springer Verlag**:** 19-33.

Milgrom, P. (2004). *Putting Auction Theory to Work*. Cambridge, Cambridge University Press.

Miller, P. A. and P. Kelle (1998). "Quantitative Support for Buyer-Supplier Negotiation in Just-In-Time Purchasing." *Journal of Supply Chain Management* **34**(2): 25-30.

Moore, D., T. Kurtzberg, L. Thompson and M. Morris (1999). "Long and Short Routes to Success in Electronically Mediated Negotiations: Group Affiliations and Good Vibrations." *Organizational Behavior and Human Decision Processes* **77**(1): 22-43.

Muller, H. J. (1996). "Negotiation Principles." *Foundations of Distributed Intelligence*. G. M. P. O'Hare and N. Jennings. New York, Wiley**:** 211-230.

Mustajoki, J. and R. P. Hämäläinen (2000). "Web-HIPRE: Global Decision Support by Value Tree and AHP Analysis." *Information and Management* **38**(3): 208-220.

Nardi, B. A. and V. L. O'Day (1999). *Information Ecologies: Using Technology with Heart*. Cambridge, MIT Press.

Neumann, D., M. Benyoucef, S. Bassil and J. Vachon (2003). "Applying the Montreal Taxonomy to State of the Art E-negotiation Systems." *Group Decision and Negotiation* **12**(4): 287-310.

NovaForum. (2000). "The Electronic Courthouse." Retrieved Jan. 10, 2004, from http://www.electroniccourthouse.com.

Nunamaker, J. F., Jr, A. R. Dennis, J. S. Valacich and D. R. Vodel (1991). "Information Technology for Negotiating Groups: Generating Options for Mutual Gain." *Management Science* **37**(10): 1325 - 1346.

Paliwal, A. V., N. Adam, V. Atluri and Y. Yesha (2003). "Electronic Negotiation of Government Contacts Through Transducers." *The National Conference on Digital Government Research*, Boston, Digital Government Research Center.

Purdy, J. M. and P. Neye (2000). "The Impact of Communication Media on Negotiation Outcomes." *The International Journal of Conflict Management* **11**(2): 162-187.

Raines, S. S. (2006). "Mediating in your pajamas: The Benefits and Challenges for ODR Practitioners." *Conflict Resolution Quarterly* **23**(3): 359-369.

Roth, A. (2002). "The Economist as Engineer: Game Theory, Experimentation, and Computation as Tools for Design Economics." *Econometrica*: 1341-1378.

Schmid, B. and U. Lechner (1999). "Logic for Media - The Computational Media Metaphor." *32nd Annual Hawaii International Conference on System Sciences*, Hawaii, IEEE Computer Society Press.

Schoop, M., A. Jertila and T. List (2003). "Negoisst: N Negotiation Support System for Electronic Business-to-business Negotiations in E-commerce." *Data and Knowledge Engineering* **47**(3): 371-401.

Schoop, M., F. Kohne and D. Staskiewicz (2004). "An Integrated Decision and Communication Perspective on Electronic Negotiation Support Systems. Challenges and Solutions." *Journal of Decision Systems* **14**(4): 375-398.

Shakun, M. F. (1988). *Evolutionary Systems Design: Policy Making Under Complexity and Group Decision Support Systems*. Oakland, CA, Holden-Day.

Smeltzer, L. R., J. A. Manship and C. L. Rossetti (2003). "An Analysis of the Integration of Strategic Sourcing and Negotiation Planning." *Journal of Supply Chain Management* **39**(4): 16-25.

Ströbel, M. (2001). "Design of Roles and Protocols for Electronic Negotiations." *Electronic Commerce Research Journal* **1**(3): 335-353.

Ströbel, M. (2003). *Engineering Electronic Negotiations*. New York, Kluwer.

Ströbel, M. and C. Weinhardt (2003). "The Montreal Taxonomy for Electronic Negotiations." *Group Decision and Negotiation* **12**(2): 143-164.

Subramanian, G. and R. Zeckhauser (2005). "'Negotiauctions': Taking a Hybrid Approach to the Sale of High Value Assets." *Negotiation* **8**(2): 4-6.

Tamma, V., S. Phelps, I. Dickinson and M. Wooldridge (2005). "Ontologies for Supporting Negotiation in E-commerce." *Engineering Applications of Artificial Intelligence* **18**(2): 223-236.

Teich, J., H. Wallenius, J. Wallenius and A. Zaitsev (2001). "Designing Electronic Auctions: An Internet-Based Hybrid Procedure Combining Aspects of Negotiations and Auctions." *Journal of Electronic Commerce Research* **1**: 301-314.

Thiessen, E. M. and D. P. Loucks (1994). "ICANS: Interactive Computer Assisted Negotiation Support." *Computer Assisted Negotiation and Mediation: Prospects and Limits*, Harvard, Harvard Law School, Cambridge, MA.

Thiessen, E. M., D. P. Loucks and J. R. Stedinger (1998). "Computer-Assisted Negotiations of Water Resources Conflict." *Group Decision and Negotiation* **7**(2): 109-129.

Thompson, L. and J. Nadler (2002). "Negotiating via Information Technology: Theory and Application." *Journal of Social Studies* **58**(1): 109-124.

Turel, O. and Y. Yuan (2008). "You Can't Shake Hands with Clenched Fists: Potential Effects of Trust Assessments on the Adoption of E-negotiation Services." *Group Decision and Negotiation*. **17**(2): 141-155

Turel, O. and Y. Yuan (2007). "User Acceptance of Web-based Negotiation Support Systems. The Role of Perceived Intention of the Negotiating Partner to Negotiate Online." *Group Decision and Negotiation*: **16**(5): 451-468.

Vetschera, R., G. E. Kersten and S. Koeszegi (2006). "The Determinants of NSS Success: An Integrated Model and Its Evaluation." *Journal of Organizational Computing*: 16(2): 123-148.

Vetschera, R., G. E. Kersten and S. Koeszegi. (2004). "User Assessment of Internet-based Negotiation Support Systems: An Exploratory Study." from http://interneg.org/interneg/research/papers/2001/02.html.

Vetschera, R., G. E. Kersten and S. Köszegi (2006). "The Determinants of NSS Success: An Integrated Model and Its Evaluation." *Journal of Organizational Computing and Electronic Commerce* **16**(2): 123-148.

Weber, M., G. E. Kersten and M. H. Hine (2006). "An Inspire ENS Graph is Worth 334 Words, on Average." *Electronic Markets* **16**(3): 186-200.

Wurman, P. R., W. W. Walsh and M. P. Wellman (2001). "A Parametrization of the Auction Design Space." *Games and Economic Behavior* **35**: 304-338.

Yang, Y. P., Y. Zhong and J. Lim (2007). "Attitudes towards Accepting Negotiation Dupport Functions in E-Marketplace Websites: An Exploratory Field Study in China." *Group Decision and Negotiation 2007*, Mt. Tremblant, InterNeg.

Yuan, Y. (2001). "Online Negotiation in Electronic Commerce." *International Conference of Pacific Rim Management*, Toronto, ACME Transactions.

Yuan, Y., M. Head and M. Du (2003). "The Effects of Multimedia Communication on Web-Based Negotiation." *Group Decision and Negotiation* **12**(2): 89-109.

Yuan, Y., J. B. Rose and N. Archer (1998). "A Web-Based Negotiation Support System." *Electronic Markets* **8**(3): http://mediamanagement.org/netacademy/publications.nsf/all_print_pk/1076.

Zlotkin, G. (1996). "Mechanisms for Automated Negotiation in State Oriented Domains." *Journal of Artificial Intelligence Research* **5**: 163 - 238.