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# Electronic Negotiation Systems: The Invite Prototype*

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## Abstract

Electronic negotiation systems support negotiators in reaching an agreement through collaboration among the involved parties. The development of these systems requires the use of a negotiation methodology and the specification of a negotiation protocol. This contribution presents the foundation of a negotiation methodology and a prototype built upon the methodology which is capable of executing multiple negotiation protocols. The prototype demonstrates the feasibility of the proposed approach, and is currently evaluated in a computer based laboratory experiment.

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# 1. Introduction

Conflict resolution is a crucial managerial task said to occupy about 20 per cent of a manager's working time [She83]. Negotiating is a means to solve conflict through collaboration among the involved parties, e.g. by sharing information about their interests, objectives, and preferences. Consider, for example, a negotiation between an engine and a car manufacturer in which the engine vendor decides to share the engine design drawings with the automotive company [Ven92]. Negotiation is conceptualized as a decentralized decision-making process in which two or more parties cannot achieve their objectives independently, and, therefore, have to collaborate to search for and arrive at an agreement, i.e. reach a consensus which satisfies the parties' requirements in the presence of limited common knowledge and conflicting interests [BKS03].

Electronic negotiation systems (e-negotiation systems or ENSs) represent a special class of negotiation support systems (NSSs) built on internet technologies, deployed on the web and capable of supporting, aiding, or replacing one or more negotiators, mediators or facilitators [KN99a]. ENSs are different from traditional NSSs deployed on standalone computers, in local-and even in wide-area networks [JF89] in terms of negotiation support and supported activities. Internet technology fundamentally changes the way a negotiation problem can be represented and a negotiation process can be structured, and allows for many more activities undertaken in negotiations to be supported, including efficient matching of potential negotiators; exchange, comparison and categorization of rich data; and the use of tools for data collection, problem structuring and analysis (for a rationale, see [BKS03]).

Current research on ENSs focuses on design issues (for examples, see [BAVK01, SJL03, Str03]) and largely neglects rigorous empirical evaluation of the specifics of ENSs (for exceptions, see [KN99b, YHD03, YRAS98]), which is surprising insofar as NSS research provides a theoretical and empirical foundation (e.g. [LB93]). There are two possible explanations to account for this phenomenon. The first explanation refers to the relative novelty of the ENS concept (see [LB93] for a similar argument with respect to NSSs). The second explanation points toward the difficulties of isolating the effects of ENSs specifics (e.g. support features, user interface elements) on negotiation outcome and negotiator performance:

1. Comparing *different* ENSs is problematic, because of the multiplicity of their differences and the interrelation of features which confounds their efficacy.

2. Comparing *different* features implemented in one ENS is problematic, because of the users' inability to assess one feature in isolation from others.

3. Generally accepted methodological standards for systematic studies, e.g. for rewarding subjects and for conducting experimental sessions, are not available, which hampers cumulative empirical research.

Our solution to remedy these problems is threefold: We propose (i) to build ENSs on a sound negotiation methodology including a formal negotiation protocol, (ii) to design and implement ENSs that are capable of supporting different negotiation protocols, and (iii) to standardize the guidelines and rules of procedure for rigorous empirical research on the specifics of ENSs.

This paper addresses the first two issues. Its purpose is to outline a negotiation methodology and to describe the design and implementation of an ENS prototype based on the methodology, which is capable of executing multiple negotiation protocols. The remainder is organized as follows. Section 2

briefly reviews the literature on computer support for negotiations. Section 3 selectively reviews existing ENSs. Section 4 outlines two important elements of a negotiation methodology, the negotiation process model and the negotiation protocol. The design and implementation of the prototype build on the methodology is presented in Section 5 and Section 6 summarizes our contributions and discusses future work.

## 2. Related work

Computer support for negotiations originated in the area of group support systems and electronic meeting systems [DNV91, DG87], e.g., the decision room setting [AJ90]. The use of computer applications to support negotiation processes was put forward in the late 1970s (for historical notes, see [SR99]). Keen [KSM78], Sprague [SC82], and others proposed to extend decision support system (DSS) capabilities to aid negotiators, which led in the early 1980s to the design of negotiation support systems (NSSs) [JJS87, FH00].

Conceptually, NSSs consist of (1) an individual networked DSS for each involved party and (2) an electronic linkage between the DSSs to allow for computer-mediated communication whereas non-computer-meditated (e.g. verbal) communication is deemed possible [LB93]. Interactive, session--oriented (comprehensive) NSSs simultaneously support the entire negotiation process of all parties and enable the parties to communicate directly with each other through electronic channels [For95]. Functionalities of comprehensive NSSs include decision support in negotiation preparation (e.g. formulation of the negotiation problem), in negotiation execution (e.g. evaluation of offers), and in post-settlement activities (e.g. analysis of outcome efficiency) in addition to the underlying electronic communication channel [Ker99]. Behavioural research on NSS has investigated the impact of different levels of negotiation support, e.g. [DFP97], different levels of conflict, e.g. [Jon88, For95], and different modes of communication, e.g. [She89, Lim00, FPJ05] on negotiation outcome and negotiator performance as well as the adoption of NSSs by end users, e.g. [LGC02].

Research on ENSs started with the commercial exploration of the internet in the mid-1990s. Kersten, Yuan, and others used internet technologies to support negotiators which led to the concept of ENSs [Ker05, YRAS98]. Recent ENS research yields results with respect to modelling ENSs [BR05], design and implementation of ENSs [KSL04], and models of e-negotiations [Pic04], among others. Ongoing behavioural research on ENS utilizes experimental and other empirical methodologies to focus on (i) ENS adoption by negotiators [YT04], (ii) the impact of different systems on the negotiation process and negotiated outcomes [TSSK05], and (iii) assessing and explaining negotiator behaviour [VKK03].

## 3. Systems review

The following selective review of ENSs should illustrate the breadth of current approaches in ENS research. For lack of space, we do not discuss systems which require the installation of a special client such as CBSS [YRAS98] as these are, strictly speaking, not ENSs; nor do we discuss hybrid systems which combine auction and negotiation elements such as Meet2Trade [WvDK+05], NegotiAuction [TWWZ01] or negotiation and workflow management systems such as GNP [BKL+00].

WebNS focuses purely on the negotiation process and does not offer any analytical negotiation support. It is based on a process model derived from Gulliver [Gul79] and separates the negotiation process into two main phases: preparation and offer exchange. Preparation is supported by 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 trade-offs among issues [YHD03].

Inspire views a negotiation as a process occurring in a particular context [Ker05]. Its main purpose is to investigate cross-cultural negotiations and to teach negotiation courses [KN99b]. The system uses a three phase process model: pre-negotiation analysis, conduct of negotiation, and post-settlement analysis. The pre-negotiation phase involves an analysis of the situation, problem and opponent, elicitation of preferences, reservation levels, and strategy. The negotiation phase involves exchanges of messages and offers, evaluation of offers and the assessment of the progress of the negotiation. The post-settlement phase involves the evaluation of the negotiation outcomes generated by, and after, the negotiation activity. The InterNeg1[1] Support System (INSS) builds on and extends Inspire [Ker98]. INSS provides a "workbench" of tools including parallel and sequential negotiations and allows for the introduction of new issues at any point during the negotiation prior to the achievement of an agreement.

SimpleNS has been developed for teaching and comparative studies on the use and effectiveness of different ENSs [Law05]. It provides a virtual negotiation table allowing its users to exchange offers and messages. This system displays the negotiation case and other information required to conduct the negotiation, presents a form in which negotiators write messages and offers, and shows the negotiation history in which all messages and offers are displayed at once. SimpleNS does not offer analytical support to the negotiators.

Taking these design artefacts into account, ENS research at its current stage seems to focus on fathoming new technology to support negotiators while making limited use of the existing negotiation theory and methodology. A closer analysis of existing ENSs reveals, moreover, that most ENS prototypes only implement one negotiation protocol. Hence, users can neither adapt the ENS to their needs nor follow a consistent methodology. This has several disadvantages from a user's and researcher's perspective.

From a negotiator's point of view, the limitation to a single protocol restricts the use of a particular ENS to the supported class of negotiation problems, which may not include their problem at hand. If, on the other hand, ENSs implement negotiation protocols which apply to a wide range of negotiation problems, i.e. are very general, they impose significant cognitive and informational demands on the users, who then need to make decisions about the selection of tools and features. Negotiators need to concentrate on the problem and process rather than compare different tools and decide about system features. It is thus advantageous that:

1. A protocol be constructed for the negotiators based on their characteristics, the negotiation problem and context, or
2. The negotiators decide on a negotiation agenda which sets a particular protocol.

From a research perspective, in particular in terms of experimental studies of ENS's use and adoption, the assessment of the impact of different system features on the process and outcomes of negotiations requires the use of systems whose differences and similarities can be easily controlled by the researcher.

[1] InterNeg is a virtual organization bringing together people concerned with negotiations [Int05].

# 4. Negotiation Methodology

A negotiation methodology describes the methods, procedures, and techniques used to collect and analyze information used in negotiation, the process of communication, exchange of offers and concessions, and arrival at an agreement or deadlock. It is important that these methods and techniques match the negotiator's capabilities, complement each other, do not produce contradictory information and – when used – contribute to the negotiation effectiveness. The use of a methodology has been advocated by negotiation experts, although their advice is typically neglected in unstructured negotiations, e.g., face-to-face or email. One of the important contributions of ENS research is to provide a methodology, which matches the negotiators' requirements and is appropriate to their problem. The use of a methodology in an ENS is required in terms of the tractability of the process and its ease of use. For the purpose of this contribution, we consider two key components of a negotiation methodology: (1) the negotiation process model, and (2) the negotiation protocol.

## 4.1 Negotiation Process

A process model provides a framework for negotiations; it organizes the activities undertaken by negotiators by grouping them into negotiation phases and by assigning different activities to each phase. It serves as a starting point for the development of ENSs and draws its significance from imposing a methodologically sound approach onto negotiators [LSM99]. With regard to the lack of ENS specific process models, Kersten adapts Gulliver's eight-phase model to a five-phase model to accommodate for ENS specifics with the phases planning, agenda setting, exchanging offers and arguments, reaching an agreement and concluding a negotiation [Ker97] (see Figure 1):

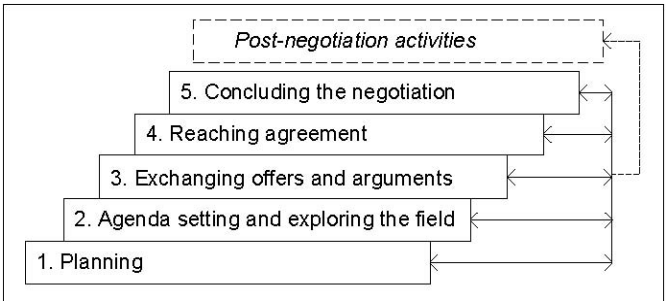


**Figure 1: Negotiation process model**

1. Planning comprises activities that each negotiator undertakes both individually and jointly. They formulate their representation of the negotiation problem including the specification of issues and options. In this phase the negotiators specify their objectives and preferences, and such negotiation-specific constructs as BATNA (best alternative to a negotiated agreement) and reservation levels [FUP91]. If the negotiators know or can learn about their opponents, they decide on strategies to be used. This phase's joint activity is the selection of the negotiation location and time, and the communication modes the negotiators will use.
2. Agenda setting and exploring the field includes the negotiators' discussion about the negotiated issues and their meaning. The discussion's result may be that new issues and options are added or some are deleted. The negotiators may also discuss the protocol they will follow, the timing of the exchanges, the deadline and in some negotiations their objectives, priorities and constraints. The result of these discussions is that the negotiators may have to revise the problem, objectives

and preferences, and also their strategies and initial tactics.

3. Exchanging offers and arguments allows the parties to learn of the others' limitations, and to identify the key issues and critical areas of disagreement. During this phase, the parties realize the potential of a compromise and can assess its main features. The analysis of a negotiation may focus on the modification of strategies, the determination of concessions and revision of aspiration levels, and on the restriction of efficient solutions to those which may be acceptable to the parties.
4. Reaching an agreement means that the parties realize that the negotiation will be successful. Having identified the critical issues, they may develop joint proposals or soften their individual limitations. The parties may also identify a limited number of possible compromises.
5. Concluding the negotiation takes place when the negotiators reached an agreement. They evaluate this compromise and consider its possible improvements. They also may discuss additional issues which, however, have no impact on the negotiations, e.g. the agreement implementation.

The post-negotiation activities phase is oriented on future negotiations. Its focus is on assessing the negotiation and its outcomes, and the negotiator's performance in order to learn what worked well and what did not. This phase is of particular importance for inter-organizational negotiations; it is used to record best practices and for knowledge transfer [Ert99].

## 4.2 Negotiation Protocol

A negotiation protocol is a model which guides processing and communication tasks of software and its users, and imposes—explicitly or implicitly—restrictions on their activities through the specification of permissible inputs and actions [KSKL05]. The concept of a negotiation protocol, or, more precisely, an e-negotiation protocol is required, on the one hand, to specify and control the activities undertaken by the negotiators, and, on the other hand, those activities performed by the ENS. The specification of activities undertaken by the negotiators and by the system allows to follow best practices, to employ verified methods and techniques, and to support partial or full automation. A formal representation of negotiation protocols is introduced in [KL05] with extensions in [KSKL05].

In order for an ENS to contribute to the achievement of an agreement effectively and efficiently, the negotiation protocol should provide a framework for guiding these activities [VKK03], e.g. by suggesting possible further activities to the negotiators and by preventing negotiators from deviating from the underlying methodology. The specification of a negotiation protocol also provides a foundation for further automation of some negotiation activities, e.g. by software agents.

The key concepts used to specify a negotiation protocol are presented in Figure 2. The process model, strategies, tactics, and activities are derived from behavioural negotiation theory, approaches, and models form the theory-based specification part. Behavioural theory posits that activities depend on the negotiators' characteristics and the negotiation context (e.g. power distribution, relationship, and the relative importance of outcomes). The characteristics and the context determine the negotiators' approaches, their strategies and tactics leading to the selection of specific activities in the different phases of a negotiation.

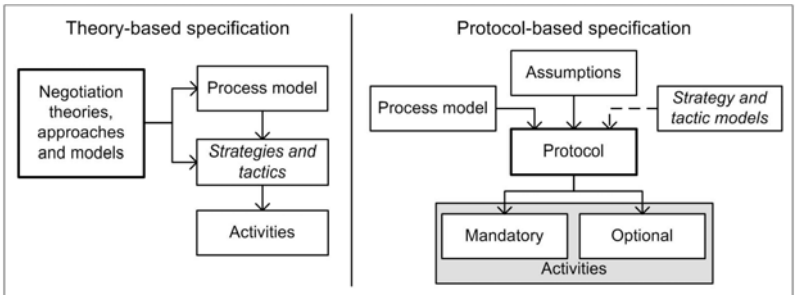


**Figure 2: Theory and protocol-based activity specification**

However, behavioural research does not provide sufficiently precise insights into the selection of activities required for the specification of an e-negotiation protocol, because of the number of possible combinations of negotiators' characteristics, interdependencies between characteristics of negotiators, dependence of the negotiators' behaviour on external factors (e.g. relationship with other stakeholders or the consideration of future situations) as well as the complexity of the problem and process [KSL04].

Hence, the specification of a negotiation protocol and, thus, the selection of activities depends—as illustrated in Fig. 2—not only on the process model, the selected strategy and tactic models, but also on assumptions on part of the protocol designer about "useful" activities and their assignment to negotiation phases (protocol-based specification part).

It follows from the above mentioned complexities that protocol designers are forced to provide a certain degree of freedom to negotiators in the selection of activities. For example, negotiators may wish to review the problem, modify their preferences, and add or remove issues in a given negotiation. On the other hand, it is desirable to force the negotiators to undertake certain activities in order to reach a better outcome. For example, forcing the negotiators to learn about the negotiation problem, to consider their own objectives and preferences, and to evaluate the counterpart's offer before making their own offers has been shown to improve the negotiation outcome by encouraging the negotiators to make informed decisions [LSM99]. Considering this trade-off is particularly important in systems which actively participate in negotiations. A proactive ENS may suggest one or more offers or propose not make an offer; or suggest to soften constraints that restrict the values of one or more issues. The dilemma between restricting the bargainers' possible activities and providing the flexibility in activities is the main issue in negotiation protocol design [KSKL05].

# 5. The Invite Prototype

## 5.1 Requirements analysis

Our intentions with developing a software prototype based on the negotiation methodology presented in Section 4 are threefold: The InterNeg virtual integrated transaction environment (Invite) is intended as:

3. A feasibility study,
4. An evolutionary prototype for further refinement of concepts, design, and implementation, and
5. Software for conducting empirical, in particular experimental negotiation research in the

laboratory and over the internet.

Based on these objectives, on our experiences in designing and implementing earlier ENSs, i.e. Inspire, INSS, and SimpleNS, and on the literature and systems review (Sections 2 and 3), the major requirements for Invite were specified as follows:

1. Provide support for the proposed negotiation methodology, in particular the process model and its activities;
2. Provide support for multiple, concurrent negotiation protocols, in particular Inspire, INSS, and SimpleNS-like protocols;
3. Provide an intuitive user interface which runs without additional software on all major web browsers; and
4. Promote reuse of existing system components.

The first two requirements imply the specification of a generic runtime environment to execute the class of negotiation protocols specified in [KL05] and [KSKL05]. Requirement 3 excludes the use of web browser plugins such as Java applets or Macromedia Flash and implies a client-pull approach. The fourth requirement has special implications for the realization of negotiation protocols, because those system components representing activities are to be reused in other protocols.

Activities are—from the perspective of the negotiators—the most concrete elements of a negotiation. They are, however, not well-suited as abstractions for the development of ENSs. As shown in Fig. 2, activities are formulated based on negotiation theories, approaches and models. In order to describe the Invite prototype and its use in electronic negotiations, we take a bottom-up approach and begin with the representation of activities.

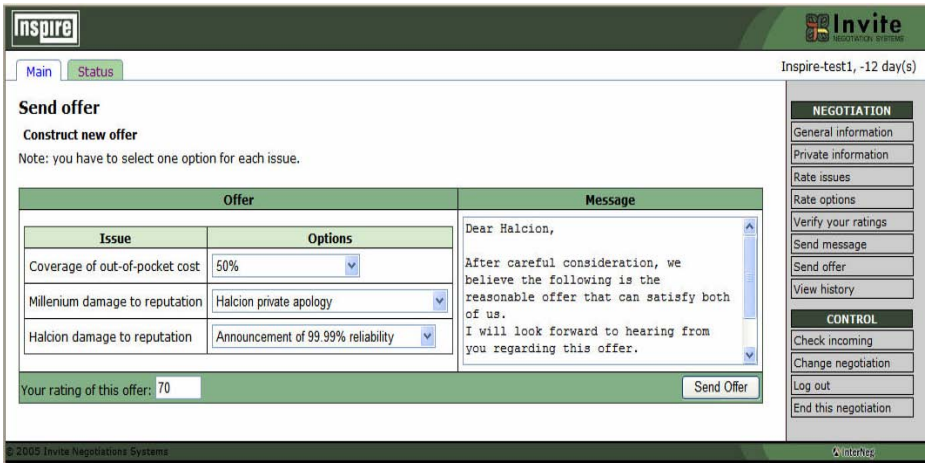


**Figure 3: Two actions on a page**

From a user's point of view, ENSs like other web-based systems are centered around the concept of pages and links between pages. A page provides information to the user (e.g. about the negotiation problem or an offer) and/or may require that the user enters information (e.g. determine problem issues or construct an offer). In order to represent activities at the page level, a finer granulated abstraction is required, because one or more activities may be undertaken on one page, e.g., a page

may display both an offer and ask the user to construct a counter-offer. We represent the negotiation activities with "actions" at this level: Every activity is associated with at least one action. An action is a code fragment which receives input from the user, stores and retrieves data, invokes external applications, and/or generates output. For example, two actions are used to generate the page shown in Fig. 3: an action to construct an offer and another action to enter a message. The notion of actions promotes reuse at the protocol level as it allows the assemblage of negotiation protocols from existing actions.

## 5.2 System architecture and design

Invite is based on a three-tier architecture (see Fig. 4). As a result of our architectural work, it has become apparent that a software architecture for ENSs needs to pay special attention to the integration of external applications, e.g., to account for computionally demanding activities such as the calculation of Pareto superior alternatives for which specialized applications are available. Starting from the requirements and the system architecture, it was decided to design and implement Invite as a web application based on a web application server in the business logic layer and web browser technology in the presentation layer.

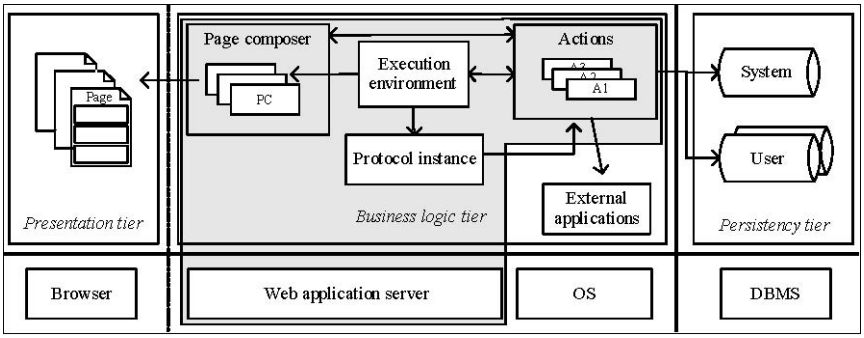


**Figure 4: Invite system architecture and design**

The business logic layer reflects the following considerations by separating execution environment, protocol instances, actions and external applications: Actions are invoked by a negotiation execution environment (a runtime engine) which runs instances of negotiations. The context, in which each instance runs, is the state in which the negotiators are at a given point in time and is defined by the activities undertaken so far. It is stored in the persistency layer during and after a negotiation and managed by the runtime engine. The execution environment selects and activates the appropriate actions according to the respective user's protocol instance. A protocol is instantiated by assigning a particular negotiator in a particular negotiation a protocol.

An important design and implementation goal is to make the execution environment largely independent of a particular protocol instance and its actions. This has two main reasons: (i) to concurrently run different negotiation protocols, and (ii) to introduce additional actions without changing the implementation of the execution environment. In effect, this separation provides essential flexibility: the execution environment runs a protocol instance without being "aware" of any internals specific to a protocol or an action. The available sets of actions constrain the design of negotiation protocols and, hence, their execution, but do not require modifications to the runtime engine itself.

The page composer sets the page layout and positions the input/output elements on the page.

Separating the user interface from the action is especially useful if the page layout itself is subject to the research design (e.g. to study of the positioning of elements on the negotiators' efficiency), but also for the internationalization of negotiations (e.g. in different languages and numeric systems).

Further design decisions led to the separation of system and user data. User data (e.g. offers and messages) is stored separately from system data (e.g. user accounts and negotiation protocols) to account for privacy and security issues and to facilitate analysis of data collected from negotiators as future applications of Invite may require the user database to be deployed offsite, e.g., at a particular researcher's or company's site.

## 5.3 System implementation

The Invite prototype has been implemented in the ColdFusion Markup Language [Mac05] in connection with the Fusebox concept [QvKL+03]. The development and production environment is Microsoft Windows 2000. MySQL is deployed as relational database management system (RDBMS) and Macromedia ColdFusion MX as web application server. The design and implementation of Invite are discussed in detail in [Law05].

Based on earlier work, we decided to pursue a table-based approach to implement negotiation protocols: When instantiating a negotiation, the contents of the tables representing a protocol in its initial state is copied to equivalent tables associated to the respective negotiator in a particular negotiator. Thus, at the beginning of a negotiation, the protocol instance is an exact copy of the initial negotiation protocol, and is then modified and adapted during the negotiation based on the users' interactions.

**Table 1: Re-use of actions**

| | **Negotiation protocol** | | |
|---|---|---|---|
| **Actions** | **SimpleNS-like** | **Inspire-like** | **Inspire-minus** |
| Read negotiation case | Used | Used | Used |
| Preference elicitation | Not used | Used | Not used |
| Construct unstructured offer | Used | Not used | Not used |
| Construct structured offer | Not used | Used | Used |
| Send message | Used | Used | Used |
| Read unstructured offer | Used | Not used | Not used |
| Read structured offer | Not used | Used | Used |
| Read message | Used | Used | Used |
| View negotiation history | Not used | Used | Used |

The prototype currently implements about 20 actions including read negotiation case, construct offer, send message, read offer, and negotiation history. Based on these actions, three negotiation protocols have been implemented: A SimpleNS-like protocol, an Inspire-like protocol, and a protocol based on the Inspire protocol yet without analytical support, termed "Inspire-minus". Table 1 illustrates the re-use of actions by these protocols.

Figures 3 and 5 illustrate the user interfaces implemented for the Inspire-like and the SimpleNS-like protocol. Both protocols have a similar user interface with the main input/output area on the left-hand side and a list of links to other activities on the right-hand side. Color themes assist the user in distinguishing protocols and demonstrate the possibility for customization. A researcher can opt for

identical color themes and positioning of user interface elements to reduce confounding differences in the user interface when comparing different protocols under controlled laboratory conditions.

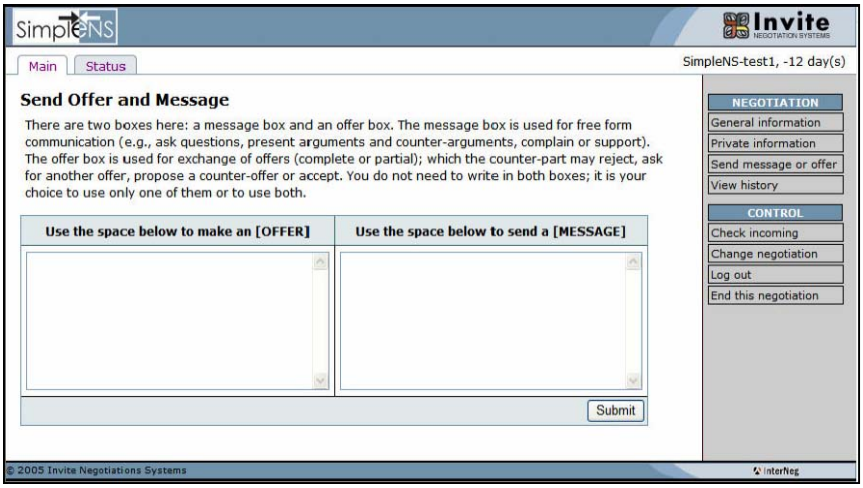


**Figure 5: SimpleNS-like user interface (bluish color theme)**

## 5.4 System evaluation

Ten dedicated system tests each with ten to 14 participants and five to seven concurrent negotiations have been conducted in order to evaluate the system design and implementation. The tests evaluated in particular the system functionality, the user interfaces, and the system performance under load. Each test has been embedded in an iterative cycle of test-design-implement-test following a evolutionary prototyping approach. The first cycles quickly revealed system failures and malfunctions which were not apparent when testing with fewer users. After the first five cycles, the system stability increased substantially and external negotiation experts joined the system tests to validate the system functionality from a methodological point of view. System performance under load turned out to be a problem in the beginning and required the revision of parts of the execution environment. One of the main causes for the relatively slow performance was detected in the invocation of external Java applications through the Coldfusion API. During the last tests, the system performed satisfactorily with seven simulated negotiations and 14 concurrent system accesses, so that the development team decided to run a pilot study for a computer-based laboratory experiment.

The study was conducted with 20 student subjects randomly selected from a database of volunteers. Ten pairs of students concurrently conducted ten bilateral negotiations in a 60 minute timeframe. The subjects were randomly assigned to one of two labs, provided with a negotiation case description, and instructed on how to use the system. The case is set in the music industry between an artist's agent and a music company's representative to promote understanding on part of student subjects. The two agents negotiate about a new contract for the artist on four issues with a total of $N = 5 \times 4 \times 3 \times 4 = 240$ alternatives. The pilot study represents a particularly realistic scenario in the sense that future experimental sessions are likely to be conducted with a similar number of users for a similar amount of time, issues and options. On the positive side, the pilot study showed that the system is capable of handling the load, while, on the negative side, certain functionality needs to be revised to improve the foolproofness of the system.

The system evaluation has shown that (i) it is feasible to build an ENS based on the proposed methodology and formal representation of negotiation protocols which is capable of executing different negotiation protocols, and that (ii) the current prototype is adequate both from a negotiation methodological and from a technical perspective, and that (iii) further laboratory experimentation is required to learn more about ENSs.

## 6. Summary and future work

Out of necessity, experimental research in technology adoption and the relationships between the tasks, user characteristics and the outcomes achieved from the human-computer interaction focuses on studying a single system [SR99], either in the same or different settings, e.g., different cases and user groups, or on the theoretical comparison of different systems features [BKL+00, JF89]. In the area of e-negotiation, the InterNeg group has been conducting both types of studies; a longitudinal study of Inspire negotiations [KN99b] and, more recently, an e-negotiation tournament of six ENSs [TSSK05]. From the perspective of system assessment, both types of research have their limitations. Firstly, the different solutions implemented in one system and its interface confounds their efficacy. Secondly, the use of several systems does not allow comparing their particular features and solutions, because they are closely interrelated with others. The comparison of the systems is also difficult, because of the multiplicity of the differences and the users' inability to assess one feature in isolation from others.

For these reasons, we decided to develop Invite. This system will allow us to study the protocols and solutions implemented in Inspire, INSS, and SimpleNS as well as solutions implemented in other systems without the noise caused by their different user interfaces and negotiation support.

Another important purpose behind Invite is the relationship between the users' characteristics and the system use, and—more broadly—the need of different solutions for different user populations. We know that the users' culture influences not only system use, but users from different cultures have different requirements regarding the system features [KVK04]. We know little, however, about what specific solutions different users prefer and how they would apply them. For example, it appears that users from low-context cultures value analytical support tools higher than the users from high-context cultures, and the latter value communication facilities higher than the former. However, since such a study was conducted with only one system we cannot conclude, for example, that different analytical tools are equally valued by one group or that there are no analytical tools that would have a high value for users from low-context cultures. A system that allows for a "plug-and-play" of various tools and solutions would provide insights that currently cannot be obtained.

Users of ENSs and other systems may not be experts in negotiations and decision making. Also, they may want to delegate some of their tasks to software agents. An important research question is to determine the suitable tasks, the specific needs of different user groups and their preferred ways of interacting with the agents. Again, this type of experimental research can be undertaken with the Invite system. Finally, we expect that the ability to easily extend and customize the Invite system will allow us to test it in the field and—if the results are successful—provide e-negotiation services useful in solving real-life problems as we have done with Inspire in the past.

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