



## **A Language-Action Approach to Electronic Negotiations**

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### **Abstract**

The current state-of-the-art in electronic negotiations shows a focus on the trade of standardised mostly inexpensive products in fixed networks of suppliers and customers. To overcome these shortcomings, the goal must be to enable the trade of complex and valuable goods and to support many-to-many marketplace for that purpose. Once valuable goods are concerned, the trade process involves negotiations which consist of a number of communicative exchanges. The Language-Action Perspective has proved to be relevant for the analysis and modelling of communication acts. We will show that a LAP approach is indeed useful as the basis for complex negotiations but only if combined with other theoretical and conceptual foundations.

**Keywords:** Electronic Negotiations, Electronic Commerce, Language-Action Perspective, Negoisst

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## **1 Introduction**

In recent years, many e-commerce applications have been developed with varying degrees of success. Looking at the business-to-business sector, the most successful approaches have been e-procurement and EDI systems whereas the business-to-consumer sector has seen many e-shops. The goal of the current paper is to support complex electronic negotiations by means of information technology. Therefore, we need to assess current approaches in order to decide whether they can deal with negotiation support sufficiently. The summary of the assessment is shown in table 1.

From a product view, most applications (such as EDI and e-procurement systems and electronic shops) deal only with *standardised products that are characterised by a low trade value*. However, there are other types of goods that are traded in traditional (i.e. non-electronic) commerce. Traditional negotiations often deal with complex and valuable goods. For example, negotiations between architects and trades that are involved in the construction project often concern non-standardised products (such as windows of a particular size and in a particular material) and usually involve the purchase of services as well (buying the window and the service of installing the windows into the house). There are usually no fixed prices but the prices depend on many issues such as the current order situation, whether the windows are standard or tailor-made, whether the window manufacturer is interested in long-term relations with the architect etc. Thus, we can identify the first goal for future electronic commerce applications, namely to enable the *electronic purchase of complex and valu-*

*able goods*. In order to achieve this goal, the main challenge is to overcome the *lack of trust* in electronic trading. Already a big problem, distrust gets more problematic if more complex and valuable products are purchased and sold via electronic channels (Lacoste, Pfitzmann, et al., 2000; Schoop and Walczuch, 2001).

Seen from a network view, we can state that applications work mainly for *1:n- or n:1-relationships*, i.e. local monopolies with either one big supplier or one big customer. For example, EDI systems work only in fixed supply networks. However, small and medium-sized companies are usually not parts of fixed supply networks but choose their different business partners for each new project. These are serious limitations that need to be overcome if the goal is to support electronic negotiations. Therefore, we can identify the second goal for future electronic commerce applications, namely that there should be *platforms such as marketplaces to enable m:n-relationships between the participants for trading*. In order to achieve this goal, the m:n-relationships require a *homogenised data exchange* since there is no prime partner who can dictate a certain standard as in the case of 1:n/n:1-relationships.

Table 1: Assessment of characteristics of successful e-commerce applications.

	<b>Product view</b>	<b>Network view</b>
Limitations	Standardised products with low trade value	1:n/n:1-relationships between customers and suppliers
Goals	Purchase of complex and valuable goods	Development of m:n marketplaces
Research Topic	Trust	Homogenisation of data exchange

We will now discuss these two research topics (homogenisation of data exchange and trust) in the following section. An assessment of the state-of-the-art in the field of electronic negotiations (section 3) will motivate our own approach that enables m:n-relationships on a marketplace for trading complex and valuable goods (section 4). A discussion of the merits and shortcomings of a LAP approach towards electronic negotiations concludes the paper (section 5).

## 2 Research Challenges

Our main aim is to support electronic negotiations. In order to do so efficiently, two research challenges have to be met. Firstly, the exchange of electronic data that is an essential part of a negotiation process needs to be homogenised in order to enable bringing together various suppliers and various customers. Secondly, the problem of trust in electronic negotiations needs to be solved by offering some trust-enhancing mechanisms to the users. The two research topics will now be assessed in more detail.

### 2.1 Homogenisation of Data Exchange

Homogenisation of data exchange is required on a marketplace (which brings together various suppliers and various buyers) because the different participants have different internal data formats and processes that need to be integrated to enable inter-organisational marketplace processes such as search for products.

The successful applications of EDI, e-procurement, and e-shops have been assessed and the main problems have been discussed above. To overcome the limitations of current approaches, EDI systems need to be open to overcome the limit of fixed supplier networks; e-catalogues which are often proprietary need to be standardised to enable comparison of offers by various suppliers; search engines operating on HTML data need to be structured to enable efficient information access. These requirements led to the development of self-describing open exchange formats such as XML. It is then possible to specify the characteristics of products. For example, a pen can be specified by its colour, its dimensions, or the type of ink used. However, it should also be possible to specify that the pen is a writing utensil and as such has certain characteristics, e.g. that it can be used to write on a particular material such as paper or overhead slides. Furthermore, there should be the possibility to look for pens in a search process and find pencils and biros. Therefore, there must be semantic enrichment that can be formalised by approaches such as description logics (Horrocks and Tessaris, 2002) dealt with in the research area of semantic web (Berners-Lee, Hendler and Lassila, 2001). Since one of the aims of the semantic web in the current context is to enable m:n-relations (and thus marketplaces), there are many participants who have different needs and requirements. Personalisation approaches aim at providing services that are tailored to individual participants. The personalisation approaches in the context of semantic web technology led to the development of semantic information brokers which enable intelligent information access based on ontologies (e.g. Bernstein and Klein, 2002). The outcome is data that is not necessarily complete, i.e. what is found might not be the complete answer to all search criteria. Even the most intelligent search mechanism can only find what is stored in a database. Thus, these approaches again deal with products that can be described at the required level of detail.

Turning back to our example of the architect wanting to purchase windows from a window manufacturer, the need for an additional step becomes obvious. The architect might require wooden windows of a particular size and form, of a particular colour, and possibly with additional characteristics such as lockable handles or wood that has been preserved according to ecological standards. Complete information about such products will never be stored in a product database of a window manufacturer because it is far too specific.

Therefore, we must go one step further and enable dynamic product specification through communicative enrichment of the semantic data. The result will be enhanced information that is now not only correct but also complete (i.e. what is required has been specified) and that was specified and agreed in transparent processes. The process of communicative enrichment is the process of electronic negotiations which is the main focus of the present work.

## 2.2 Trust in Electronic Trade

One of the main reasons why companies do not engage in electronic commerce is the lack of trust in e-commerce approaches which is often uttered as concerns about security (ECIN, 2002). There are security mechanisms that can ensure confidentiality (e.g. through encryption mechanisms such as secure socket layer (SSL) or IPsec), authenticity and non-repudiation (e.g. through digital signatures together with certificates and public key infrastructures (PKIs)), and integrity of data (e.g. through digital signatures or hash algorithms). Furthermore, there can be process-oriented support of a

security infrastructure as proposed, for example, by the SEMPER project. It aimed at providing a secure infrastructure for electronic marketplaces (Lacoste, Pfitzmann, et al., 2000) ensuring fairness, i.e. no payment without delivery of goods and vice versa. In addition to security, there are other approaches that can enhance trust in electronic commerce (Wehmeyer, Riemer and Schneider, 2001). In our work, a dynamic trust concept is used. We view trust as a process element that is built on experiences (c.f. Gans, Jarke, et al., 2002) and we deal with trust in the current work in three ways.

Firstly, we aim at a flexibilisation by informing through communication. This means that problems are solved through structured communication which provides flexible processes so that existing problems can be tackled rather than being restricted by inflexible bureaucratic structures. Secondly, we aim to combine actions and speech acts which provides a means for judging reliability of business partners. The business partners can make various promises but, in the end, they will be judged by their actions, i.e. whether they fulfil their promises and obligations. Thirdly, traceability is aimed at eliminating distrust among business partners. If distrust exists, it can help to look at the processes that have been conducted and to judge whether the person can be trusted. Therefore, transparent processes are required that can be traced back in case of conflicts. The work on trust is a part of our approach to electronic negotiations which fulfils the three requirements discussed.

It is obvious by now that the negotiation phase is a communication-oriented phase and that both homogenisation of data exchange and enhancing trust have to do with communicative exchanges between the business partners. Before outlining our own work on negotiations (and thus discussing how the two research challenges have been met), the state-of-the-art in electronic negotiations is assessed to show why a language-action approach is not only helpful but indeed called for to close existing gaps.

### 3 Electronic Negotiations

Negotiations are an essential part of a business transaction. The negotiation phase is the most communication-intensive transaction phase. In the negotiation process, the participants exchange communication acts which can involve oral or written communication or a combination of both. Negotiations usually resemble a dance around each other with the negotiators wanting to look at the partner from each angle. A negotiation - in particular one with a new partner - usually starts with informal exchanges. The goal is to find out how the other partner reacts which should result in the ultimate decision of whether or not to enter into formal negotiation processes. Once the informal exchanges have provided enough information about the partner and the assessment was judged to be successful, the partners will enter into serious negotiations. In that part of the business negotiation, all details concerning the contract are discussed. Therefore, two negotiation phases can be distinguished, namely an informal and a formal phase or an information part and an agreement part (Peters, 2000) which proves the argument that there is always a double-level language consisting of an informal and a formal communicative layer (Robinson, 1991).

Electronic negotiations are business negotiations conducted electronically, for example via the internet. Thus, electronic negotiations follow patterns similar to traditional negotiations but offer more features due to the underlying IT support, e.g. rea-

soning about fulfilment of commitments, automated workflows, process support of the communicative exchanges.

The current state-of-the-art in electronic negotiations represents the emphasis on the automation of negotiation processes (Peters, 2000; Rebstock, 2001; Sandholm, 1999) and the counter-movement of negotiation support (Kersten and Noronha, 1999; Schoop, Jertila and List, 2003; Ströbel, 2002; Yuan, Rose and Archer, 1998). In this section, we will review different models of electronic negotiations.

### 3.1 Quantitative Negotiation Models

Quantitative approaches automate the negotiation process aiming at finding an economic optimum. In recent years, these approaches have become multi-attribute (as opposed to the first single-attribute) ones. Electronic auctions and negotiation agents are quantitative automated negotiation approaches.

Electronic auctions have become very popular in recent years. They work according to the normal auction principles, i.e. bids can be made until a pre-specified deadline and the best bid is computed according to a transparent algorithm (Peters, 2000). There are different auction models that determine the auction process (Bichler, 2000; Rebstock, 2001). English auctions work as ascending-bid auctions whereas Dutch auctions work as descending-bid auctions. Participants know of the bids of competitors in open auctions (sometimes called open-cry auctions) whereas sealed-bid auctions do not reveal bids but open all bids at the same time. In the first-price auction, the bidder with the highest bid wins and pays the price (s)he offered whereas the bidder with the highest bid wins but only pays the price of the second highest bid in Vickrey (or second-bid) auctions.

The most common auctions are single-attribute auctions which mostly concern the price of the good. Recently, approaches to multi-attribute auctions have been proposed (Bichler, 2001) where various characteristics can be combined and the best outcome is computed accordingly.

The second form of automated negotiations are negotiation agents. Negotiation agents are intelligent software agents that show the following characteristics (Dignum and Cortés, 2001):

- **Autonomy:** Agents can work independent of human intervention.
- **Pro-activeness:** Agents have their own agenda that they try to achieve without requiring explicit input of the principal at each step.
- **Reactiveness :** Agents can react to changes in their environment so that they can modify their pro-active behaviour (e.g. choose a different strategy, modify a goal) according to the current context.
- **Social ability:** Agents can interact with their surroundings, including cooperation with other agents.
- **Personalisation:** Agents can have their own goals and a profile that is based on the preferences of their principals.
- **Intelligence:** Agents can learn to enhance their performance over time

Negotiation agents take over parts of or the complete negotiation process for the principal (Dignum and Cortés, 2001; Macredie, 1998; Maes, Guttman and Moukas, 1999). The above characteristics are particularly useful for the negotiation process. For example, a user can specify a negotiation strategy and a particular goal that the agent should achieve (personalisation and autonomy) interacting with other agents (social ability) on a marketplace. Such an interaction will be dynamic and thus the agent has to adapt the plan and strategy to the changing contexts (pro-activeness and reactiveness). However, most implementations do not yet implement all of the above characteristics (Dignum, 2001) as most agents have a limited autonomy and intelligence.

The above models of auctions and agents are certainly not distinct. There can be combinations. For example, agents often take part in auctions. Rebstock argues that the most common approaches are agent-based approaches for single attribute English auctions (Rebstock, 2001).

From a computer science viewpoint, the automation models are created for software to take over routine tasks and thus to rationalise the process. From an economic viewpoint, the automation models are created to reduce costs in interaction.

The automation models represent rather simple negotiation models which have a number of limitations that are often overlooked (Dignum, 2001; Kersten, Noronha and Teich, 2000; Schoop, Jertila and List, 2003).

The main limitation is that the automated approaches enable trading only of standard products that can be described in detail and which are mostly invaluable goods. Agents must know exactly which products are required and an auction is carried out for particular product characteristics, usually the price and sometimes for multiple attributes. There is no dynamic product specification or communicative enrichment process during the negotiation. The product characteristics are fixed at the beginning of a negotiation process to enable comparability of requests and offers. In the case of auctions, there must be a transparent algorithm computing the best bid. Auctions are a straightforward process where no discussion, explanation, or justification is possible. Once a bid is placed, it is rated according to the other bids received. Negotiation agents follow pre-specified processes and interact in defined agent languages. They make offers or requests that can be compared to those made by other agents. Both auctions and agent approaches follow strict protocols that do not allow for flexible interactions tailored to specific requirements of particular negotiation context. Reducing a negotiation to a strictly rational process means that certain processes requiring complex communication (e.g. when discussing offers or justifying a particular counter-offer) cannot be represented.

Therefore, these approaches alone are no solution to the challenge of enabling the trade of complex goods in m:n marketplaces. Their advantage is that they can specify the agreements in detail both quantitatively and content-wise.

### 3.2 Negotiation Support Models

The limitations of quantitative automated models led to the development of a second class of negotiation models, namely that of non-automated negotiation support models (Kersten and Noronha, 1999; Schoop, 2002b; Schoop et al., 2003; Weigand, Schoop, et al., 2002; Yuan, Rose and Archer, 1998). The aim of these approaches is to support human negotiators in their complex negotiations by providing technological support while leaving the control over the negotiation process with the negotia-

tors. While the above automation models are solution-oriented, negotiation support is process-oriented (Rebstock, 2001; Yuan, Rose and Archer, 1998): the automation is oriented towards generating a negotiation result while negotiation support is oriented towards supporting the process of negotiation. The decisions are made by the human negotiators.

In general, approaches in the area of negotiation support are either primarily communication-centred or primarily document-centred (Weigand, Schoop, et al., 2002). This can be explained by looking at business interactions in more detail and from different viewpoints (Kalakota and Whinston, 1997). Approaches emphasising the *business process perspective* aim at automating the business process for efficient business transactions. A business process usually involves some information exchange. Therefore, documents play an important role as the medium for structured information that can be stored, accessed, shared, exchanged, and used. For example, workflow systems fall into this category. A certain document such as a contract can initiate workflow processes such as the delivery of goods. Approaches to reduce costs as emphasised by the *service perspective* also involve business documents such as customer records, customer mailings, process descriptions etc. On the other hand, business processes involve coordination activities which are usually carried out by means of organisational communication. Efficient communication structures can help companies to improve workflows, to save on time and correction activities, or to improve group work. The *communication perspective* thus deals with the exchange of communication acts aiming at concluding a business deal.

### 3.2.1 Communication-Centred Approaches

Communication-centred approaches deal with communication modelling of business processes and with communication process support.

An important class of communication-centred applications stems from the Language-Action Perspective (LAP) (Schoop, 2002a; Winograd and Flores, 1986). The Language-Action Perspective is based on speech act theories, mainly Searle's Theory of Speech Acts (Searle, 1969) and Habermas' Theory of Communicative Action (Habermas, 1985).

One of the earliest applications of LAP is the Coordinator (Winograd and Flores, 1986). It was motivated by the observation that the mere application of technology in an office did not necessarily lead to more efficient work structures; indeed it sometimes created more problems than it solved. The Coordinator is a system supporting conversations in an office setting including negotiations. Its basic principle of interaction consists of four steps (request by the speaker, followed by the hearer's promise, followed by the hearer's report of completion, and finally the speaker's declaration of completion) with the possibility of further actions in case of problems at all stages. The Coordinator provides a communication protocol that prescribes the interactions and makes the communicators aware of their current context with respect to the interaction model. Evaluation of the Coordinator showed that it is over-structured which led to many unsuccessful application in an organisational context (Suchman, 1994).

DEMO stands for Dynamic Essential Modelling of Organizations and aims to provide a modelling method for effective business process modelling and redesign (Dietz, 1994; Dietz, 2002). A business is seen as consisting of three models with corresponding business processes. The documental model represents that part of the business in which the actors store, transmit, and reproduce information via docu-

ments. The informational model represents that part of the business in which information is exchanged. The essential model represents that part of the business in which actors carry out performative conversations that establish new things. As the name claims, the essential model is the important one that is to be supported whereas the way certain new things are achieved is not important: "We fully abstract from the way a coordination act is performed, e.g. whether it is done by letter or Email or via a web-site." (Dietz, 2002, p. 3).

As an example of a communication-oriented negotiation system, Email has been proposed for negotiation and contract management (Lee, 1998a). This approach can be seen as a counter-movement against over-structured approaches such as the Coordinator or some highly structured business process models. The case is exemplified for negotiation in countries such as South Korea where the IT infrastructure is underdeveloped. It is argued that negotiating by Email enables complex negotiations since the Email can contain any negotiation item, not just the price. However, the author concedes that automated negotiation systems are required that can understand natural language used in Emails to enable structured processes.

The WebNS system is a process-driven web-based negotiation support system (Yuan, Rose and Archer, 1998). WebNS offers dialogue windows that are used for the exchange of messages. The messages themselves are natural language utterances without a prescribed structure. A third party acting as a mediator can monitor the exchanges and can intervene or offer help. The negotiation process is supported according to the stages in Gulliver's negotiation model (Gulliver, 1979). All negotiation items need to be agreed upon before the negotiation process starts. Messages are automatically documented by storing them in a database.

We will now discuss the general limitations of communication-oriented approaches to negotiation.

The main limitation is that the message content is unstructured. For example, speech act theory treats the message content as a primitive. Consequently, LAP approaches such as the Coordinator or DEMO do not analyse the communicative content further which means that the content of an exchange is not accessible in a structured or formal way. In Email negotiations, the content is unstructured since no explicit template or protocol is defined. Although the exchanges in WebNS are more structured than in mere Email exchanges, the content itself is still completely unstructured. In the present context of business negotiations, the content of the utterance is of prime importance since it represents what the negotiation is about, in particular the decisions and commitments involved. The negotiators must understand each other and must reply to the content of an offer, request, or counter-offer.

The second limitation is that there is no support of business documents although they represent written communication acts and are also an important part of a business transaction as discussed before. For example, the DEMO approach explicitly leaves out documents since they are not deemed to be important which is contradictory to the negotiation situation. The contract is of prime importance. Furthermore, the way an utterance is made can have consequences on the outcome. For example, an order made by Email might result in a discount. This practice is often found in online airline or railway booking systems. For example, Lufthansa offers some prices that are very competitive and that are only valid if the ticket is booked via the internet.

Due to the unstructured communication content, the exchanges are not transparent to the user which might prevent the elimination of distrust. If there is no possibil-



ity to analyse the communication content in a structured or formalised way, then there is no way to link the actions to the commitments made during a negotiation process and documented in a message.

Due to the discussed limitations, communication-centred approaches represent only a part of the negotiation process but have the advantage of enabling a process of dynamic product specification in a negotiation.

### 3.2.2 *Document-Centred Approaches*

Beside communication-centred approaches, the second class of negotiation support approaches are document-centred ones. In such approaches, the exchange of documents is the main goal. Business documents such as contracts are stored and can be (cooperatively) authored, maintained, accessed, retrieved, modified, and deleted. We will now discuss both research and commercial approaches in order of increasing sophistication.

EDIFACT systems work with templates and aim at agreeing on a particular document representing a business agreement (Angeles, 2000; Lee, 1998b). There are messages that are exchanged but these messages are standardised templates that can be filled in but do not provide for interactive discussions or explanations. Thus, EDIFACT systems are a good example of systems focusing mainly on standardised business documents.

Electronic contracting systems aim at supporting the contracting process by means of process support which is also mainly document-centred (Lee, 1998b; Schopp and Stanoevska-Slabeva, 2000). Electronic contracting can be defined as the digital process of offer exchange and negotiations leading to legally binding contracts that can be monitored. Lee (1998b) views closed electronic contracting as the interactions between partners within existing trading relationships. Such context is similar to the one found in EDI relations. Open contracting is viewed as contracting among parties with no prior trading relations. Such open forms can be and should be supported by information technology. Contracting can then be seen as the exchange of commitments through business documents (Lee, 1998b).

The well-known negotiation support system INSPIRE (Kersten and Noronha, 1999; Kersten and Noronha, 2000) implements a document-oriented approach. Its purpose is to offer a system for teaching and training. To this end, INSPIRE offers pre-defined scenarios such as negotiating about mountain bikes. The negotiable items are pre-specified and the users need to specify potential values and declare their preferences for each of these items. For example, the user might be willing to negotiate about the colours red or green, prefers a red bike and indicates this preference. Furthermore, the colour is less important than the price. Therefore, the colour is estimated at 20% whereas the price is specified with the value 50%. Each negotiation step which represents a (counter-)offer is then evaluated during the negotiation process according to the preferences. The system shows a percentage according to the optimal settlement for the user. Once a negotiation deal is made, there is the possibility to evaluate the outcome. The system might suggest a different compromise which is better for both participants, i.e. a pareto-optimal deal. The values for each negotiation item are specified in a template. Even though there is a field for communication exchanges, the communication is not supported and, furthermore, the communication does not have any influence on the deal.

We will now discuss the general limitations of document-oriented approaches to negotiation.

The main limitation of document-oriented approaches is that important information about the negotiation process is lost. These approaches record the outcome of the negotiation process but not the communication that led to a particular decision which means that the history behind an agreement is not considered. The reasons for an agreement, the explanations, the justifications, the reasons for particular contractual items, the author of modifications etc. are important for the negotiation process and they are crucial for the success of a negotiation. The outcome of a negotiation process can be assessed in terms of the negotiation strategies that were employed, i.e. whether a particular strategy was efficient. Efficiency does not only concern the outcome of a negotiation (i.e. the deal struck) but also the characteristics of the negotiation process such as duration of negotiation, compromises, number of threats that had to be used. Such an analysis is impossible if the communication occurring during the process of negotiation is not recorded and only the outcome can be analysed.

The dynamic product specification through communicative enrichment is limited to structured written exchanges present in a document that usually prescribes a certain structure. Therefore, some specific product characteristics might be more difficult or even impossible to specify through structured document exchange.

The flexibility in communication that can help to solve individual problems during a negotiation process is limited due to the prescribed structure of a document which requires the specification of particular elements and prevents the specification of other elements.

Therefore, the discussed limitations of approaches that are purely document-centred show that such approaches represent the negotiation process only partially.

## 4 An Integrated Approach to Electronic Negotiation Support

The two main classes of models for electronic negotiations, i.e. quantitative (automated) and negotiation support (non-automated) models, have been assessed in the previous section. It has been discussed that each model on its own can only represent a part of a negotiation process. Therefore, we developed an integrated approach that combines communication management with document management and extracts concepts from the negotiation content. Thus, the approach integrates the advantages of communication-oriented models with document-oriented models and bridges the gap to multi-attribute models via ontologies. Rather than providing an extensive overview of our framework and system which has been done elsewhere (Schoop, Jertila and List, 2003), we will only briefly describe it and then discuss the merits of a LAP approach.

### 4.1 Negoisst

We developed the negotiation support system Negoisst that enables complex electronic negotiations. It is based on the following observation. In electronic negotiations, negotiators need to communicate via a written medium. They need to specify their offers and, more importantly, they need to be able to justify them, explain, question, reply, suggest, threat etc. Thus, the medium of exchange are messages that can carry these communicative acts. To avoid ambiguity of the agreements, there must be

a medium to write down the agreements in a more formal and structured way. Thus, the second important feature of a negotiation is a document. Each negotiation aims at finalising a business contract which is a document. The contract evolves over time during the negotiation steps. Therefore, Negoisst combines structured message exchange and cooperative document management (Schoop and Quix, 2001; Schoop, Jertila and List, 2003). In the following paragraphs, the features of Negoisst will be briefly outlined and illustrated.

#### 4.1.1 *Message Exchange*

The negotiation in Negoisst is conducted via message exchange. Here, messages are the medium for formal and informal conversations between the negotiation partners.

##### **Message Type**

To avoid misunderstandings about the messages, there is a message type that needs to be specified by the user. The message type indicates the intention of the sender, e.g. whether the utterance is meant as a formal order or an informal enquiry about certain products or services. The message type is based on speech act theory (Habermas, 1985; Searle, 1969) that argues that each speech act consists of a propositional content (P) and an illocutionary force or point (F) and has the form F(P).

In addition to the types which have been developed specifically for business interactions, we also use a categorisation of message types. The Theory of Speech Acts proposes five categories of speech acts that we have adopted for the current work (Schoop and Quix, 2001; Searle, 1969). For example, assertives such as reports or statements represent facts of the real world; commissives such as promises represent the author's intention to carry out the action in question; directives such as orders or requests represent the author's intention to get the recipient to carry out a particular action. Furthermore, it is important to know the consequences for each message type. For example, a formal offer commits the author to do as offered if the recipient accepts the offer

The categorisation of utterances is also used for the order of the negotiation process. A negotiation protocol is implemented which controls the negotiation workflow. The message types are important for prescribing how a negotiation can proceed. Negoisst offers the possibility to start a negotiation with a request or an offer message; a request can only be answered by a counteroffer, an acceptance, or a rejection; a negotiation can only end with an act of acceptance or an act of rejection. Furthermore, turn-taking is implemented to avoid negotiators replying to their own messages.

##### **Message Content and Message Categories**

The content of the message is specified in natural language to enable the negotiators to express what they mean in the most powerful and intuitive way. On the other hand, natural language can often be ambiguous. Therefore, Negoisst offers message categories for defining a semantics for parts of the message.

Consider the situation shown in figure 1. Partner Manage writes that "After extensive internal discussion, the management board agreed to offer you an increase of 2." The "2" here is meant as a salary increase, not as an increase on the number of teachers, not as a decrease in the number of working hours etc. In this context (which shows an extract from an international negotiation competition), Manage wants to

specify how “2” is meant, i.e. wants to explicitly specify the semantics. This is done by clicking on one of the contract points that come from an ontology or a list of terms. These are items that the negotiators want to talk about. By clicking on it, the contract point is included into the natural language text message and thus specifies exactly what is meant. The semantic enrichment process also works the other way round: the negotiator can highlight parts of the natural language message (in this case “2”) and links it to the semantic categories (in this case “Salary”) displayed on the right hand side.

This ensures that the exchanges are unambiguous to a large extent. The categories are pre-defined for a particular business branch. However, the list cannot and indeed should not be complete since there are always contexts in which new negotiation items can occur. Therefore, the list can be extended by the user, i.e. the user can define new categories and place them in the appropriate place in the tree of categories (Schoop and Jertila, 2004).

### **Negotiation Area**

When we first developed our system Negoisst, there was only one negotiation area as shown in figure 1. In our evaluation experiments, it became clear that there must be an additional negotiation area that also corresponds with Habermas’ notion of different modes of resolving problematic validity claims. In the formal (or “red”) negotiation area shown in figure 1, serious negotiations take place. The negotiators are aware that their interactions will lead to commitments and that the negotiation can only be terminated in this area. In the informal (or “green”) negotiation area, informal interactions can take place that do not lead to obligations. Negotiations often commence in this area before the negotiators decide to start serious interactions. At each point in time, it is possible to leave one area and enter the other area.

Figure 1 shows the message exchange in Negoisst with all elements discussed in this section. Since the complete exchange is stored, traces of messages and of documents are available for the negotiators, e.g. as a memory aid, to assess different negotiation strategies, for coordination of several negotiation processes etc. Therefore, it is possible to see the history behind an agreement, the reasons for a specific decision, the process of negotiating about a specific topic, and the justification for the final contract. By storing the interactions and by making the obligations explicit, monitoring of the contract fulfilment is enabled (Schoop and List, 2001).

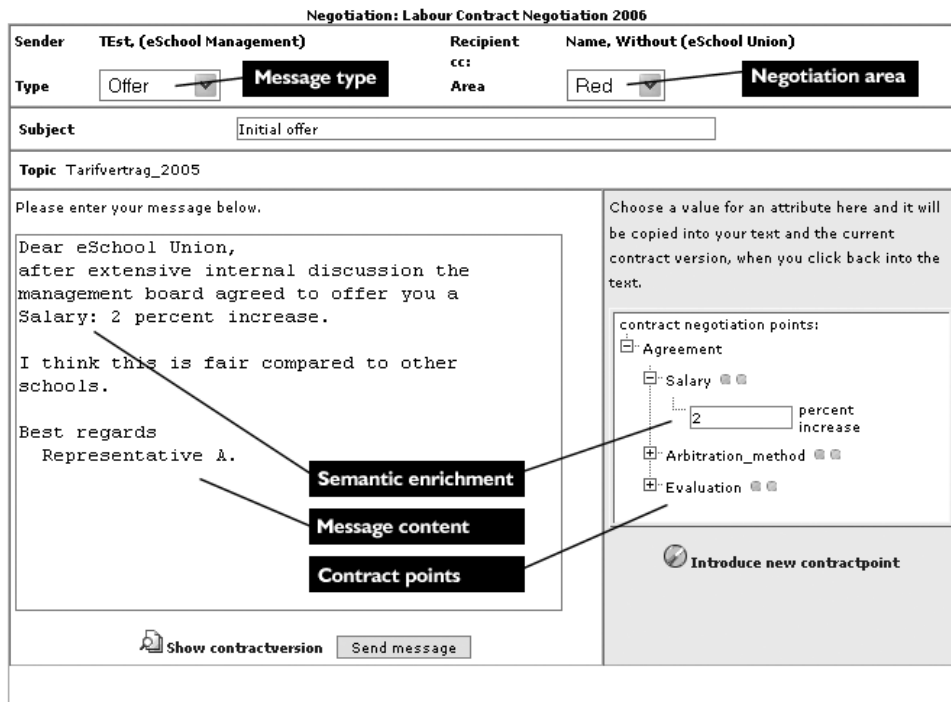


Figure 1: Message Management in Negoisst.

#### 4.1.2 Contract Management

As mentioned before, the second important element in Negoisst is the concept of a document. Documents in this context represent versions of the business contract as the outcome of a negotiation. The contract versions are automatically deduced from the message content including the semantic categories. Thus, there is a link between the messages and the documents. Each message leads to a new contract version. Figure 2 shows the contract version related to the message shown in figure 1.

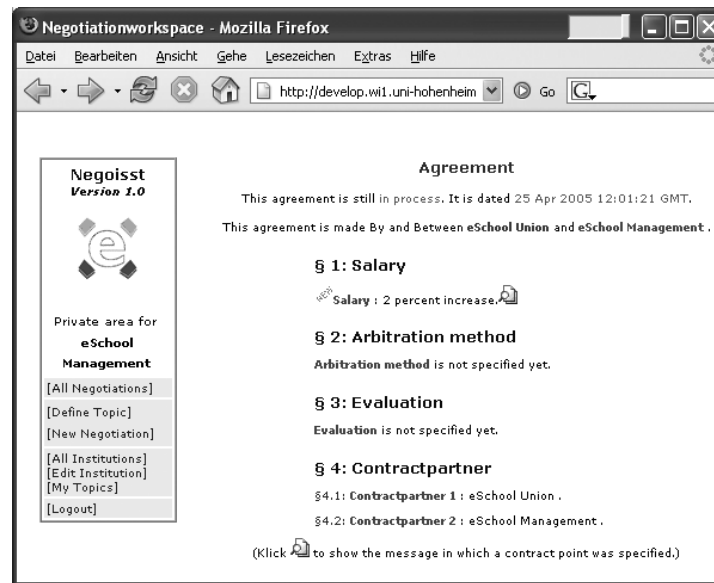


Figure 2: Contract Management in Negoisst.

At each step in the negotiation, it is possible to view the current contract version resulting from the current message. Negoisst offers a trace of messages and a trace of documents. Furthermore, the combined view of messages and documents implements the link between these two concepts. In each document, the negotiator can click on any contractual item which will open the message that introduced that particular item with the current value. Therefore, it is possible to trace back the interaction for each element in each contract version.

Furthermore, it is possible to make obligations explicit. For example, the cost of living adjustment is an item that needs to be ensured by the management of the school as shown in figure 2. Therefore, it is made clear for all negotiators involved what the own obligations are, what the obligations of the business partner are, and which actions need to be taken next.

#### 4.1.3 Contract Fulfilment

Although Negoisst is mainly a negotiation system, it has been extended to offer functionalities for the fulfilment phase as well.

The user can view a list of obligations. Furthermore, it is possible for the user to check the satisfiability of these obligations during a negotiation and thus to find out whether the current contract version could be fulfilled if it became the contract. Thus, potential problems can already be envisaged during the negotiation when reparative action can still be carried out. The aim is to avoid drawing up contracts that will be difficult or impossible to fulfil.

Once the contract has been drawn up, the second functionality of contract fulfilment becomes relevant. The list of obligations is adapted to the current context. In particular, actions that have already been conducted (such as delivery of products or the payment) are considered to construct the current list of obligations. Some obligations depend on a certain time value such as payment before a deadline. If the deadline is past, then the obligations to pay before that deadline no longer holds because

the obligation can never be fulfilled. It is possible to find out these problems, to alert the users, and to initiate pre-specified actions (such as reminders, contractual penalties etc.).

## 5 Discussion

In this article, an approach towards effective and efficient business communication in electronic commerce was presented. The aim is to support negotiations on marketplaces concerning complex and valuable goods. Two research challenges were identified that need to be successfully met to enable m:n marketplaces for complex goods. Firstly, the data exchange on a marketplace needs to be homogenised. Secondly, trust in the transaction process needs to be increased.

These two topics are linked through negotiation support. Homogenised data exchange can lead to correct data that is not necessarily complete. In our approach, negotiations represent the process of dynamic product specification through communicative enrichment. Our approach offers flexible negotiation processes that are transparent and can be traced back in case of conflicts. These features help to eliminate or decrease distrust among the negotiation partners. Our approach is based on speech act elements. They are combined with action sequences that can lead to obligations. Thus, negotiation partners can be judged by their actions (which have been communicated during the negotiation) which can increase reliability of negotiation partners.

Our work contributes to efficient support of business communication in electronic commerce. The negotiation phase is the most communication-intensive phase of a business transaction. Efficient support of electronic negotiations will lead to business communication processes of a higher communicative quality. The Language-Action Perspective is highly relevant for supporting negotiations. Once valuable goods are concerned, negotiations are an essential element of a business trade process. Such a negotiation consists of many communication steps that need to be analysed and understood before IT support can be of any help. We found LAP to be most useful for these purposes. However, it also became clear that purely concentrating on the communication aspects of e-negotiations would have severe shortcomings which would lead to a merely partial support. Therefore, additional theories and areas have been used as an extension of our LAP foundation. For example, we used negotiation theories as well as economic theories and theories of interorganisational systems.

Our research goal for future work is to integrate our system with the different negotiation models that are also in use, i.e. auctions and agents. Depending on the negotiation context, a combination of different models might be the most useful choice for efficiently enabling and support electronic negotiations that meet the challenges of the current e-commerce landscape.

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