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INFLUENCE OF NEGOTIATION SUPPORT APPROACHES ON THE CONCESSION BEHAVIOR OF NEGOTIATORS

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Kurzfassung

Die vorliegende Arbeit beschäftigt sich mit dem Einfluss von ökonomischen und behavioristischen Unterstützungssystemen auf das Konzessionsverhalten in elektronischen Verhandlungen. Hierbei wird untersucht, ob theoretische Konzepte zur Entscheidungsunterstützung auch tatsächlich die angestrebten Dimensionen operativ unterstützen.

Um diese Forschungsfrage zu beantworten, wurden in einem Verhandlungsexperiment mit Studierenden Daten gesammelt und die ausgetauschten Angebote im Verhandlungsprozess hinsichtlich der Quantität und Qualität der verwendeten Konzessionen analysiert.

In diesem Zusammenhang beobachten wir den Einfluss der verschiedenen Unterstützungsmethoden auf den Verhandlungsprozess, sowie auch auf die Ergebnisdimensionen von elektronischen Verhandlungen. Darüber hinaus führen wir eine spezifische Phasenanalyse durch, wobei wir die Konzessionen vor, und nach der Nutzung des verhaltensbezogenen Unterstützungssystems vergleichen.

Die Ergebnisse dieser Untersuchung zeigen, dass die alleinige Verwendung von ökonomischer Unterstützung und die Verwendung von ökonomischer und verhaltensbezogener Unterstützung in Kombination, tatsächlich einzelne Aspekte des Konzessionsverhaltens im Verhandlungsprozess beeinflussen.

Die Studie wurde im Rahmen des "e-Nego-motion" Projekts (unterstützt durch den FWF) durchgeführt, welches die Entwicklung von effektiven Verhandlungssystemen erforscht. (Gettinger, et al. 2012a; Mitterhofer, et al. 2012).

Abstract

The present study analyzes the impact of economic and behavioral decision support systems on the concession behavior in e-negotiations. Therefore, we investigate whether theoretical concepts of decision support actually support the intended operational dimensions.

To answer this research question, we analyze the data gathered by a student negotiation experiment, and employ an offer-process analysis to measure the quantity and quality of employed concessions.

In this context, we observe the impact of the applied support systems on the negotiation process and on outcome dimensions of e-negotiations. What is more, we conduct a specific phase analysis, where we compare concessions before, and after the use of the behavioral support tool.

The results of this study show that the sole use of economic decision support and the use of economic and behavioral support in combination, actually affect some aspects of the concession behavior during the negotiation process.

The study was conducted in the context of the "e-Nego-motion" project (supported by the FWF), which investigates the development of effective negotiation support systems. (Gettinger, et al. 2012a; Mitterhofer, et al. 2012)

Index of Abbreviations

BATNA	Best Alternative to a Negotiated Agreement
BDS	Behavioral Decision Support
DSS	Decision Support System
EDS	Economic Decision Support
ENS	Electronic Negotiation Support System
Hyp.	Hypotheses
$H_{\#}(\#)$	Numbered Hypothesis
MAUT	Multi Attribute Utility Theory
N	Sample Size
NA	Negotiation Assistant
NoDS	No Decision Support
NSS	Negotiation Support System
p	Statistical p-Value
r	Statistical Effect Size
U	Test Statistic for Mann-Whitney test and Wilcoxon Signed Rank Test
χ^2	Test Statistic Chi-Square
z	Statistical z-Score
ZOPA	Zone of Possible Agreement

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1 Introduction

1.1 Problem

During the last decades negotiation support systems (NSS) have been developed to assist negotiators before, during, and after a negotiation (Kersten and Lai 2007). Thereby, a NSS was described as a system that supports negotiators with specific decision support and provides an electronic communication channel to conduct the negotiation (Lim and Benbasat 1992-93). In doing so, such systems aid negotiators to "undertake complex negotiation tasks including conflict identification, management and resolution, search for consensus, assessment of agreement stability and equilibrium analysis" (Kersten and Lai 2007, p. 553ff).

What is more, the increased use of electronic media in business (e.g. e-mail) raised the requirements on NSS in the last years. Thus, negotiation support systems needed to facilitate communication and provide negotiation analysis support via internet technologies (Kersten 2005). In that way, electronic negotiation support systems (ENS) were introduced, with the same capabilities of NSSs but with the additional feature to conduct negotiations via web.

In several studies, the impact of different types of NSSs on the behavior of negotiators was examined (Delaney, et al. 1997; Druckman, et al. 2004; Foroughi 1998; Gettinger, et al. 2012b; Koeszegi, et al. 2006; Rangaswamy and Shell 1997). Therein, the results showed versatile effects of the applied support approaches- where it was found that NSSs can aid negotiators in different ways to cope with complex negotiation tasks.
Although managers use approximately 20% of their working time for conflict resolution (Foroughi 1998)- however, the employment of ENSs in business has not faced its breakthrough. This can be reasoned by either the practical application of the systems or the required support by negotiators is not mature yet (Koeszegi, et al. 2009).

As stated above, there have already been conducted a large number of studies to evaluate the impact of NSSs on the behavior of negotiators during the negotiation process, as well as on outcome dimensions from a theoretical perspective. Therein, different types of negotiation support approaches were

examined. On the one hand, an economic support approach aims to raise the efficiency of a negotiation (i.e. quality of an agreement); On the other hand, behavioral support approach aids negotiators to reach an agreement at all.
In previous studies, the focus was on the use of either economic or behavioral decision support of negotiations. In our study, we examine the use of economic and behavioral support approaches in combination. Thereby, we investigate whether the theoretical benefits of each support approach actually aid negotiators to solve the so-called negotiation dilemma.
Thus, in our study, we examine the impact of the economic decision support (presentation of utility values und a history graph, via the ENS *Negoisst*) and the behavioral decision support (e-mediation, via *vienNA*) together, to get a deeper insight into the impact of those ENSs on the behavior negotiators.

1.2 Research Question

The aim of this master thesis is the evaluation of the impact of the two different support approaches (economic and behavioral – alone, as well as in combination) on the concession behavior of negotiators and on outcome dimensions. Therein, we will use the method of offer-process analysis to examine the influence of the applied ENS on the approach of negotiators towards each other. In more detail, we will focus on the substantive values (i.e. utility values) of exchanged offers during the negotiation process. We will subdivide the analysis in two different parts.

i) At first, we will examine the impact of the applied support approaches on the offer exchange during the negotiation process. In more detail, we will observe the composition of different offer packages, the frequency, size and quality of used bargaining steps, and the most common outcome dimensions. To investigate those measures we conducted an empirical laboratory experiment. Therefore, we assigned student participants to four different treatment groups (EDS+BDS: negotiators provided with economic and behavioral decision support, EDS: negotiators provided with only economic decision support, BDS: negotiators provided with only behavioral decision support, and NoDS: negotiators were not provided with any decision support). To get a holistic perspective of the influence of different support approaches, the influence of the concession behavior will be

linked to various outcome dimensions. The Figure 1.1 illustrates the allocation treatment groups as well as the relation to process and outcome dimensions.

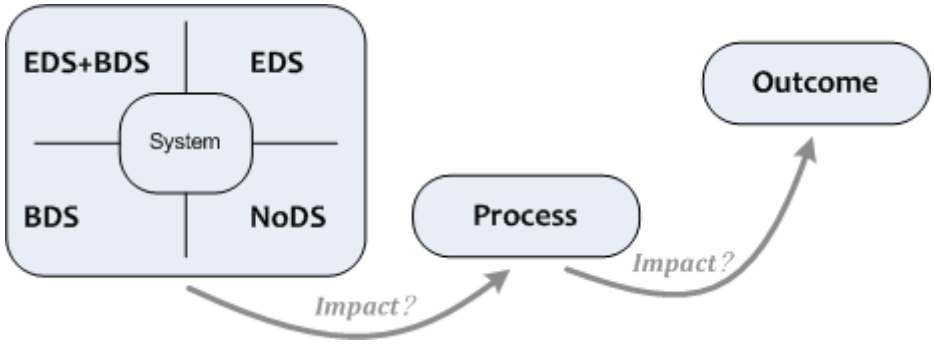


Figure 1.1: Impact of treatments on process and outcome, adapted from (Brandmayr and Okruch 2011, p. 3)

ii) Secondly, we will conduct a specific phase analysis where we compare the behavior of negotiators before and after the use of the behavioral support *vienNA*. In that respect, we will examine the use of different bargaining steps in the two treatment groups which had access to *vienNA*. In more detail, we will i) evaluate the impact of BDS within a treatment- when we compare the offer exchange of negotiators before and after the use of *vienNA*; and ii) we will compare the offer exchange of negotiators between the two treatment groups after the use of *vienNA*. The Figure 1.2 illustrates the allocation treatment groups as well as the relation to process and outcome dimensions.

Figure 1.2: Impact of *vienNA*, pre/post and post/post comparison, adapted from (Brandmayr and Okruch 2011, p. 4)

1.3 Structure of Thesis

The remainder of the thesis will proceed in the following way. In chapter 2 we will present the theoretical background. Therein we will present general information about negotiation, mediation and negotiation support systems. In

chapter 3, we will formulate the hypotheses based on scientific literature review to investigate the research question. Chapter 4 will then outline the experimental design and the used methods of analysis. Therein we will also give a description of the applied NSSs (*Negoisst* and *vienNA*) and introduce the negotiation case. In chapter 5 we will present the results of the statistical tests. Finally, in chapter 6 we present a discussion of the results, a conclusion including the limitations of the study, and an outlook on further research areas.

2 Theoretical Background

"Negotiations occur in a wide variety of political, economic, and social settings" (Lim and Benbasat 1992-93, p. 28) and can be defined as "dynamic processes in which the parties involved communicate to exchange offers, make concessions, raise threats, or otherwise influence each other in order to reach an agreement" (Filzmoser and Vetschera 2008, p. 421).

When people join a negotiation, they want to resolve a problem or conflict, in order to reach an agreement which is better than their best alternative to the negotiated agreement (BATNA) (Teich, et al. 1994). What is more, rational negotiators do not want to reach an agreement which is just feasible (i.e. an agreement that does not exceed the available resources and does not violate any reservation level of both negotiation parties), but try to choose the best alternative.

2.1 Negotiation Dilemma

Negotiation problems can vary in their direction of preferences of the negotiating parties (Teich, et al. 1994). Thereby, problems can be classified according to their integrative potential as i) congenial, ii) mixed, or iii) uncongenial problems. Firstly, i) congenial problems describe a win-win situation, where "both parties agree to maximize (minimize) each criterion"(Teich, et al. 1994, p. 58). ii) In mixed problems, not all of the preferences match between the parties, and in iii) uncongenial problems, all preferences are diametrically opposed.

However, as most cases are mixed or uncongenial problems, the maximization of utility- the (economic) efficiency of a negotiation, goes a long with a minimization of the likelihood to reach an agreement- the effectiveness of a negotiation. This phenomenon is the so called "negotiation dilemma" (Pruitt 2002; Zartman 2002) and represents a trade-off between these two prominent outcome measures. In more detail, concerning the concession process in negotiations, it describes the confrontation of distributive and integrative negotiation approaches. On the one hand a distributive bargaining style with small concessions is focused on the negotiators' focal goals and interests- while on the other hand, a integrative bargaining style uses larger concessions, where own goals and interests are put aside and the main goal of the negotiator is to reach an agreement.

Economic and behavioral approach

From an economic perspective, an agreement can be achieved in a solution space, where the joint utility for both negotiating parties of a settled negotiation can be depicted as illustrated in Figure 2.1.

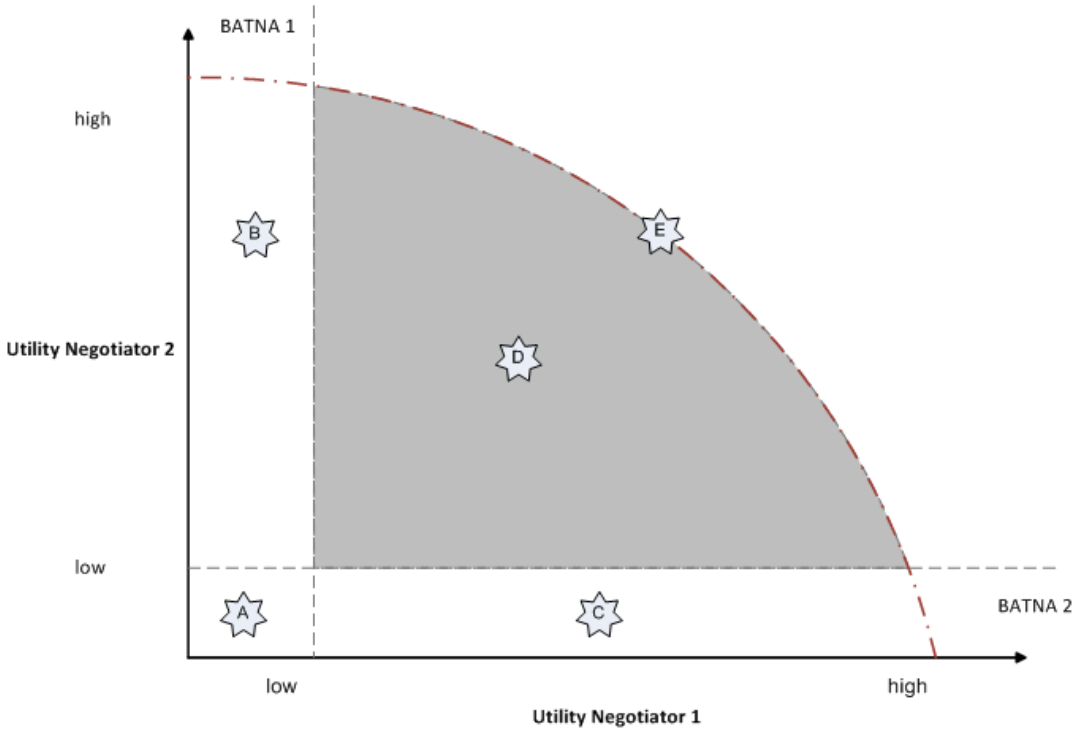


Figure 2.1: Solution Space - efficient Agreements adapted from (Kersten, 2010, Chapter 11, p. 5)

Therein, rational negotiators will not settle below their BATNA levels (alternatives A, B, and C), but instead, they will search for solutions within the grey space above (D), or even along the efficient frontier (E). In the case, negotiators manage to settle at the efficient frontier, they reach a Pareto-optimal agreement (Kersten 2010). This describes a solution, where no further improvement for one party is possible, without a reduction of utility for the other party. A way to assist negotiators in the process of maximizing utility, is the Multi-Attribute-Utility-Theory (MAUT) (Salo and Hämäläinen 2010), which is employed in the experiment and will be described later on.

As we described the negotiation dilemma above, the more negotiators aim to maximize their own utility, the lower is the likelihood to reach an agreement.

This dilemma can then lead to a stalemate, impasse, or deadlock of the negotiation. A way to overcome such difficult situations in negotiations is the employment of mediation, which represents the second negotiation support approach of the underlying study. Mediation is known to be one of the oldest forms of conflict resolutions and can be described as "mediation is assistance to two or more interacting parties by a third party who — at that time — has no power to prescribe agreements or outcomes" (Wall and Dunne 2012, p. 219). Thereby, the goal of mediation is to raise the effectiveness of a negotiation as it usually increases the prospects of reaching an agreement. In doing so, mediation aims to increase the mutual understanding of each parties' needs and the whole situation. In that way, mediation gives advice to the parties to improve the relationship and to exchange priority information. As a consequence, mediation aids to realize the most conflicting issues and helps to find suitable and feasible solutions for both parties. As a part of this process, the flexibility of the negotiating parties can be increased, as negotiators are aided in constructing new package solutions or to engage in logrolling offers (Druckman, et al. 2004; Druckman, et al. 2002). Furthermore, mediation can help to save face while making concessions and thereby helps to move toward the opponent (Carnevale and Pruitt 1992).

In the underlying study, we will examine how both support approaches (economic and behavioral) aid negotiators to solve the negotiation dilemma. In that respect, we expect an impact of the applied support systems on the quantity and quality of concessions and thereby also on the efficiency and effectiveness of negotiations.

2.2 Negotiation Support Systems (NSS)

To improve negotiation outcomes and to assist negotiators during the negotiation process, negotiation support systems (NSS) have been developed in the last decades. In the following part of this chapter we will give a short overview of the common types of NSSs.

Since the 1970s different negotiation support systems have been developed, to assist disputants during, before and after a negotiation. At first, there were *decision support systems* (DSS). The purpose of DSSs was to help individuals or parties, to set and evaluate their preferences and objectives. Next, *negotiation*

support systems were evolved, which had the same capabilities as a DSS, but additionally enabled communication with another party. Today, the support of negotiations is possible with e-negotiation systems (ENS). These systems employ internet technologies which proffer negotiators a tool to facilitate, organize or automate activities in the negotiation. Furthermore, it is now possible to aid more negotiators, or behavioral support like mediators to the negotiation (Kersten and Lai 2007).
We can distinguish three classes of ENS which differ in their degree of intervention (Kersten 2005).

i) Passive systems: (e.g. e-mail, chat), that "facilitate communication and interaction of the users located in different places, and presentation of their ideas, offers and arguments" and "may also provide support for the storage, organization and retrieval of information" (Kersten 2005, p. 74)

ii) Active facilitative-mediation systems (e.g. "*Negoisst*" (Schoop, et al. 2003), *vienNA* (Druckman, et al. 2002)), that " aid the users in the formulation, evaluation and solution of difficult problems, concession-making and construction of offers, and assessment of the process and agreement" (Kersten 2005, p. 74)

iii) Proactive intervention-mediation systems (e.g. "Aspire" (Kersten and Lo 2003)), "have the same capabilities as the active facilitative-mediation systems, but they also are capable of coordinating the negotiators' activities, critiquing their actions, and making suggestions as to what offer should be made or what agreement should be accepted" (Kersten 2005, p. 74 ff).

During the last decades research of economic decision support showed mixed results on the efficiency and effectiveness of negotiation (Delaney, et al. 1997; Foroughi, et al. 1995; Gettinger, et al. 2012b; Koeszegi, et al. 2006; Rangaswamy and Shell 1997). What is more, considering research of behavioral decision support, a study comparing types of e-mediation showed versatile effects on the effectiveness of a negotiation (Druckman, et al. 2004).

In the underlying experiment we applied the ENSs "*Negoisst*" (Schoop, et al. 2003) and "*vienNA*", which is a successor to the mediation to "NA" (Druckman, et al. 2004; Druckman, et al. 2002). While *Negoisst* offers both communication and

economic decision support, *vienNA* offers an mediation support as it provides advice on how to overcome a possible impasse (Druckman, et al. 2004; Druckman, et al. 2002). Both, *Negoisst* and *vienNA*, are classified as active facilitative-mediation systems- as they enhance negotiators' mental capabilities. In more detail, *Negoisst* aids negotiators with the visibility of preferences and individual utility values and *vienNA* assists negotiators to identify possible solutions.

To analyze the impact of the applied ENSs on the use of concessions, we employed an Offer-Process Analysis on a micro and macro level, as well as a specific Phase – Analysis. The latter included the comparison of the offer-process of negotiators before- and after the use of the behavioral support software *vienNA*. What is more, a Frequency Analysis for the underlying experiment was conducted at the Department of Labor Science and Organization at the Vienna University of Technology (Brandmayr and Okruch 2011). The above mentioned methods of analysis will be introduced in more detail in the chapter “Methodology”.

3 Hypotheses

In the following part we will present the hypotheses to analyze the impact of the applied NSSs on the negotiation process from various perspectives. To get a more detailed view on the offer exchange, the first three parts of this chapter deal with the "offer structure", the "offer direction", and the "offer quality", during the negotiation process. In the fourth part, various outcome measures are analyzed, and the in the fifth and last part, we compare the performance of negotiators before- and after the use of the behavioral support system "*vienNA*". The remainder of the sets within the different parts of hypotheses is organized as follows. i) We introduce and define the independent measure (for the declaration of the calculation see chapter “Results”; ii) We explain the meaning of the tested variable for the support of e-negotiations; and in the third section iii) we argument the hypotheses.

3.1 H_I - Offer Structure

The first part of the hypotheses covers the impact of the different NSSs on the offer composition and on the amount of exchanged offers. While the first set deals with the topic of complete starting-offers, the second set observes the number of proposed contracts. In the third and last set, we take a closer look into the offer process during the negotiation, as we observe the frequency of simultaneously changed values in different issues along the progress of the negotiation.

3.1.1 $H_I(1)$ Complete first-offer packages

i) A complete offer package is defined, as where " all issues of the negotiation are specified or, equivalently, that all issues not explicitly addressed in an offer remain unchanged from the previous offer″ (Filzmoser and Vetschera 2008, p.424). This implies that if in the first offer of a negotiation all issues are specified, all subsequent offers are completely specified as well, and therefore no incomplete offer is sent during the whole negotiation process.

ii) The “consideration of issues in isolation” can state a major stumbling block in negotiations, as possible mutual trade-offs are not realized by the negotiation parties (Delaney, et al. 1997; Foroughi 1998; Foroughi and Jelassi 1990; Foroughi, et al. 1995; Raiffa, et al. 2002). The more frequent use of complete-offer packages is expected to facilitate mutual trade-offs, which then

should possibly lead to a (mutually beneficial) agreement. Thus, the impact of different NSSs on this issue is examined in the following hypotheses.

iii) E-mediation aims at increasing negotiators' flexibility, as it provides advice on how to move from initial positions or to discover new solutions (Druckman, et al. 2004). In that way, it supports negotiators to overcome possible impasses (Druckman, et al. 2004; Filzmoser and Vetschera 2012). In the conducted experiment, the e-mediation system *vienNA,* implemented in the BDS conditions (BDS and EDS+BDS), is accessed on demand by pushing a button, which then opens the interface of the mediation support. However, we do not expect that negotiators face an impasse or any other type of conflict which requires mediation support, before the sending of the first offer. Thus, we predict no influence of BDS on the use of complete first-offer packages and therefore no significant difference in the subject between users in this condition and users with NoDS.

It was found that users with economic decision support, send significantly more complete offer packages than users of passive systems (Koeszegi, et al. 2006). In the conducted experiment the economic decision support system *Negoisst*, implemented in the EDS conditions (EDS and EDS+BDS), requires negotiators to prepare complete offer-packages before the beginning of the negotiation. Thus, we expect that users in the EDS conditions send significantly more complete first-offer packages than users with NoDS, and thereby also more complete first-offer packages than users with BDS.

In summary, as we expect no impact of NoDS and BDS on the use of complete first-offer packages, we predict that users in the EDS conditions send more complete first-offer packages than users to which this type of support is not available. In more detail, hypotheses $H_I(\mathbf{1})$a-f are summarized as follows.

$H_I(\mathbf{1})$a: Negotiators provided with BDS exchange complete first-offer packages similarly often to those provided with NoDS.

$H_I(\mathbf{1})$b: Negotiators provided with EDS exchange complete first-offer packages more often than those provided with NoDS.

H_I(**1**)c: Negotiators provided with EDS exchange complete first-offer packages more often than those provided with BDS.

H_I(**1**)d: Negotiators provided with EDS+BDS exchange complete first-offer packages more often than those provided with NoDS.

H_I(**1**)e: Negotiators provided with EDS+BDS exchange complete first-offer packages similarly often to those provided with EDS.

H_I(**1**)f: Negotiators provided with EDS+BDS exchange complete first-offer packages more often than those provided with BDS.

Figure 3.1: Expected relation - complete first-offer packages

3.1.2 H_I(2) Number of proposed contracts

i) The "number of proposed contracts" represents the amount of exchanged offers during a negotiation .

ii) The number of proposed contracts during a negotiation is a main characteristic of negotiations and has therefore been part of many prior studies (Delaney, et al. 1997; Foroughi 1998; Foroughi, et al. 1995; Koeszegi, et al. 2006; Rangaswamy and Shell 1997). It was found that NSSs differ in their influence on the number of exchanged offers and on the provided information within this offer (Koeszegi, et al. 2006). Thus, the impact of the applied NSSs on this issue is examined in the following hypotheses.

iii) It was found that users with economic decision support exchange relatively more offers than users with passive support (Delaney, et al. 1997; Foroughi, et al. 1995; Koeszegi, et al. 2006; Rangaswamy and Shell 1997). Compelling evidence for this phenomenon was observed in the absence of the instant evaluation of the utility ratings of users with NoDS, where users exchanged relatively more task-related information within an offer (e.g. information about issues, priorities and needs etc.) than users with EDS (Koeszegi, et al. 2006). In concrete terms, this means that users with EDS exchanged priority information more implicitly, within a higher number of offers and their utility ratings, and not explicitly, within the

attached message of an offer. Thus, we predict that users with EDS exchange relatively more offers than compared to users with NoDS.

The e-mediation support system *vienNA* gives tactical advice to negotiators, on how to approach each other during the negotiation. Thereby, the system is expected to increase the amount of exchanged priority information and aids negotiators to enhance task-related communication (Druckman, et al. 2004; Druckman, et al. 2002). Furthermore, we above-mentioned that a higher exchange of task-related information within an offer results in a lower number of proposed offers. Thus, we predict that users with BDS exchange relatively fewer offers than compared to those with NoDS, and thereby also significantly fewer than users with EDS.

In the combined condition EDS+BDS, we expect a neutralizing effect on the subject- as on the one hand, the provided advice of BDS to exchange more task-related information, and on the other hand, the focus on the own utility ratings of EDS, are expected to have an equal strong, but opposed impact on the number of exchanged contracts. Thus, we predict that there is no significant difference in the number of proposed contracts between users with EDS+BDS and those of users with NoDS.

In summary, we assume that users with NoDS exchange relatively more offers than compared to users with BDS, but relatively fewer offers than users with EDS. Thereby, we expect an equalizing effect on the subject in the combined condition EDS+BDS, whereas no significant difference in the number of proposed contracts between users in this condition and users in the NoDS condition is expected. In more detail, hypotheses $H_I(2)$a-f are summarized as follows.

$H_I(2)$a: Negotiators in the BDS condition exchange relatively fewer offers than those in the NoDS condition.

$H_I(2)$b: Negotiators in the EDS condition exchange relatively more offers than those in the NoDS condition.

$H_I(2)$c: Negotiators in the BDS condition exchange relatively fewer offers than those in the EDS condition.

H_I(**2**)d: Negotiators in the EDS+BDS condition exchange offers similarly often to those in the NoDS condition.

H_I(**2**)e: Negotiators in the EDS+BDS condition exchange relatively fewer offers than those in the EDS condition.

H_I(**2**)f: Negotiators in the EDS+BDS condition exchange relatively more offers than those in the BDS condition.

EDS > EDS+BDS = NoDS > BDS

Figure 3.2: Expected relation - number of proposed contracts

3.1.3 H_I(3) Generation of alternative offer packages

i) In the "generation of alternative offer packages", we analyze the number of simultaneously changed values in different issues, when employing a concession, trade-off or demand bargaining step.

ii) The following hypotheses for the generation of alternative offer packages are a sequel to the first set of hypotheses H_I(**1**), which covered the use of complete starting offers. To get a deeper insight into the alternating offer composition during the negotiation process, we expect that the simultaneous change of values in different issues is a suitable variable to be tested. The subject shall represent an indicator for the support of negotiators in dealing with cognitive difficulties. Thus, the impact of the applied NSSs on this issue is examined in the following hypotheses.

iii) It was found that economic decision support helps negotiators to overcome cognitive difficulties in the generation of alternative offer packages (Foroughi 1998; Foroughi, et al. 1995). Thereby, it is expected that the instant evaluation of the utility ratings for different offer packages, facilitates negotiators during this process (Foroughi 1998; Foroughi, et al. 1995). Thus, we predict that users with EDS change more values in different issues when employing a concession, trade-off or demand bargaining step than compared to users with NoDS.

E-mediation support intends to enhance negotiators' flexibility, to move from their initial positions and to employ trade-off bargaining steps (Druckman, et al. 2004; Druckman, et al. 2002). We expect that the provided advice in *vienNA* makes it

easier for negotiators to consider simultaneous changes of values in different issues and to propose various offer packages. Thus, we predict that users with BDS change more values in different issues when employing a concession, trade-off or demand bargaining step than compared to users with NoDS.

As stated above, both provided decision support systems EDS and BDS, are expected to increase the number of changed values in different issues when employing a concession, trade-off or demand bargaining step. To compare these two conditions among one another, we need to take a closer look on the provided support. On the one hand, users with EDS, can change values in different issues simultaneously more easily, because they are always aware of their own preferences and their accumulated utility rating for the prepared offers (Foroughi 1998; Foroughi, et al. 1995; Gettinger and Koeszegi 2012). What is more, it was found that users provided with graphical support via history graph, as it is implemented in the EDS condition, are more aware of their needs and interests (Gettinger and Koeszegi 2012), and can therefore more easily cope with the cognitive load to offer alternative offer packages. On the other hand, BDS gives tactical advice on how to move from initial positions and to employ logrolling offers (Druckman, et al. 2004; Druckman, et al. 2002). We anticipate that EDS has a stronger increasing impact on the subject than BDS, as we predict that the cognitive ease of application in the EDS condition has an overweighting effect in relation to the given advice of how to consider the subject in the BDS condition.

In the combined condition EDS+BDS, we anticipate an intensifying effect for the subject, as both decision support systems are expected to increase the number of simultaneously changed values. Thus, we predict that users in the EDS+BDS condition change more values in different issues, when employing a concession, trade-off or demand bargaining step than users in any other condition.

In summary, we expect that users in both conditions EDS and BDS, change more values in different issues, when employing a concession, trade-off or demand bargaining step than compared to users with NoDS. Moreover, we predict that EDS has a stronger increasing impact on the subject than BDS, and we anticipate an intensifying effect in the combined condition EDS+BDS, in which users are supposed to change more values in different issues, when employing a

concession, trade-off or demand bargaining step than compared to users in any other condition. In more detail, $H_I(3)$a-f are summarized as follows.

$H_I(3)$a: Negotiators provided with BDS change significantly more values in different issues when employing a concession, trade-off or demand bargaining step than those provided with NoDS.

$H_I(3)$b: Negotiators provided with EDS change significantly more values in different issues when employing a concession, trade-off or demand bargaining step than those provided with NoDS.

$H_I(3)$c: Negotiators provided with EDS change significantly more values in different issues when employing a concession, trade-off or demand bargaining step than those provided with BDS.

$H_I(3)$d: Negotiators provided with EDS+BDS change significantly more values in different issues when employing a concession, trade-off or demand bargaining step than those provided with NoDS.

$H_I(3)$e: Negotiators provided with EDS+BDS change significantly more values in different issues when employing a concession, trade-off or demand bargaining step than those provided with EDS.

$H_I(3)$f: Negotiators provided with EDS+BDS change significantly more values in different issues when employing a concession, trade-off or demand bargaining step than those provided with BDS.

EDS+BDS > EDS > BDS > NoDS

Figure 3.3: Expected relation - generation of alternative offer packages

3.2 H_{II} - Offer Direction

While the first part of hypotheses covered the impact of the different NSSs on the offer composition and on the amount of exchanged offers, the second part of hypotheses deals with use of different bargaining steps during the negotiation process. Therein, we investigate the frequency and magnitude of different bargaining steps, and distinguish between their impact on the sender and receiver of an offer.

3.2.1 $H_{II}(1)$ Frequency of concessions and trade-offs

i) Following the "classification of bargaining steps" (Filzmoser and Vetschera 2008), bargaining steps, are differentiated as follows (see also Figure 3.4):

- A concession step is, when the demand in at least one issue is decreased and all other issues remain unchanged compared to the previous offer.
- A demand step is, contrary to a concession step, when the demand in at least one issue is increased and all other issues remain unchanged compared to the previous offer.
- A trade-off step is, when in at least one issue the demand is increased and in at least one issue the demand is decreased, and all other issues remain unchanged compared to the previous offer.
- An insistence step is, when all issues remain unchanged compared to the previous offer.

Change of demand in issue			Step type
Decrease	No change	Increase	
x			Concession
x	x		Concession
	x		Insistence
		x	Demand
	x	x	Demand
x		x	Trade-off
x	x	x	Trade-off

Figure 3.4: Differentiation of bargaining steps, cited from (Filzmoser and Vetschera 2008, p.425)

ii) The investigation of the use and frequency of concession and trade-off bargaining steps belongs to the more recent studies of negotiation analysis (Koeszegi and Vetschera 2010). In a reasonable negotiation the more frequent use of concessions and trade-offs, instead of insistence offers[1] (Filzmoser and Vetschera 2008), are the common way to reach an agreement (Gettinger, et al.

[1] demand offers were hardly used in their experiment, and did not show significant differences concerning the probability to reach an agreement (Filzmoser and Vetschera 2008)

2012b). Thus, the impact of the applied NSSs on this subject is examined in the following hypotheses.

iii) Mediation helps negotiators to save face when making concessions, as it can establish a positive frame about the negotiation when negotiators are reluctant to move toward their opponent (Carnevale and Pruitt 1992). Concerning the use of ENS, empirical evidence for the more frequent use of concessions was found when preferences where visible to both negotiating parties (via a negotiation dance graph) (Gettinger, et al. 2012b). The e-mediation software *vienNA*, gives tactical advice on how to overcome impasses and helps to increase the understanding for the opponents' preferences. Thereby, it displays the flexibility in critical issues via a flexibility grid to both parties (Druckman, et al. 2004; Druckman, et al. 2002). Furthermore, it is expected that a greater knowledge about the opponents' preferences makes it easier for negotiators to engage in value creating trade-off offers (Hyder, et al. 2000), which should aid negotiators in the approach towards each other. All of the above stated arguments contribute to the expectation that users with BDS use relatively more concession and trade-off bargaining steps than compared to users with NoDS.

It was found that users with economic decision support make more concessions and multiple issue offers than users with passive support (Koeszegi, et al. 2006). Furthermore, it is expected that users who are able to deal with multiple issue offers are more likely to engage in trade-off offers (Henderson, et al. 2006). As a result, we predict that users provided with EDS, use more concession and trade-off bargaining steps than compared to users with NoDS.

As stated above, users in both decision support systems EDS and BDS, make more concessions and trade-offs than users with NoDS. To compare these two conditions among one another, we again have to take a closer look on the particular provided support. On the one hand, users with EDS, are always aware of their own preferences and their accumulated utility rating for the current and foregone sent and received offers via the history graph. We anticipate that the higher awareness and the easier access of the utility of exchanged offers, should then ease a consistent concession behavior for both negotiating parties (i.e. a consequent approach of both negotiating parties towards each other, where both lower their overall utility step by step) (Foroughi 1998; Foroughi, et al. 1995;

Gettinger and Koeszegi 2012). On the other hand, BDS helps negotiators to save face when making concessions, and aids to engage in logrolling offers (Druckman, et al. 2004; Druckman, et al. 2002). It is again expected that EDS has a stronger positive impact on this subject than BDS, as we predict that the cognitive ease of application in the EDS condition (Gettinger and Koeszegi 2012) to prepare different offer packages, has an overweighting effect than just the given advice of how to consider the subject in the BDS condition.

In the combined condition EDS+BDS, we predict an intensifying effect on the subject, as both decision support systems are expected to increase the frequency concessions and trade-offs. Therefore, we assume that the frequency of concessions and trade-offs of users in the EDS+BDS condition is higher than those of users in any other condition.

In summary, we anticipate that the frequency of concessions and trade-offs of users in the EDS and BDS conditions, is higher than compared to users in the NoDS condition. Moreover, we predict that EDS has a stronger increasing impact on the subject than BDS. We then expect an intensifying effect on the subject in the combined condition EDS+BDS, where the frequency of concessions and trade-offs is higher than compared to users in any other condition. In more detail, hypotheses $H_{II}(\mathbf{1})$a -f are summarized as follows.

$H_{II}(\mathbf{1})$a: Negotiators provided with BDS exchange concessions and trade-offs more often than those provided with NoDS.

$H_{II}(\mathbf{1})$b: Negotiators provided with EDS exchange concessions and trade-offs more often than those provided with NoDS.

$H_{II}(\mathbf{1})$c: Negotiators provided with EDS exchange concessions and trade-offs more often than those provided with BDS.

$H_{II}(\mathbf{1})$d: Negotiators provided with EDS+BDS exchange concessions and trade-offs more often than those provided with NoDS.

$H_{II}(\mathbf{1})$e: Negotiators provided with EDS+BDS exchange concessions and trade-offs more often than those provided with EDS.

H_{II}**(1)**f: Negotiators provided with EDS+BDS exchange concessions and trade-offs more often than those provided with BDS.

EDS+BDS > EDS > BDS > NoDS

Figure 3.5: Expected relation - frequency of concessions and trade-offs

3.2.2 H_{II}(2a) Frequency of sender's utility decreasing offers

i) A "sender's utility decreasing offer" is defined as an offer, where the overall utility of a subsequent offer for the offer sender is lower than in the previous offer. The Figure 3.6 illustrates the outcome for the sender and receiver of an offer. Therein, the utility of the sender of an offer sender is either increased (when the offer is made in the I or II quarter), or decreased (when the offer is made in the III or IV quarter). Analogously, the utility of the receiver of an offer is either increased (when the offer is made in the I or IV quarter), or decreased (when the offer is made in the II or III quarter). In concrete terms, a sender's utility decreasing offer takes place, when the offer is made in the III or IV quarter, illustrated in Figure 3.6.

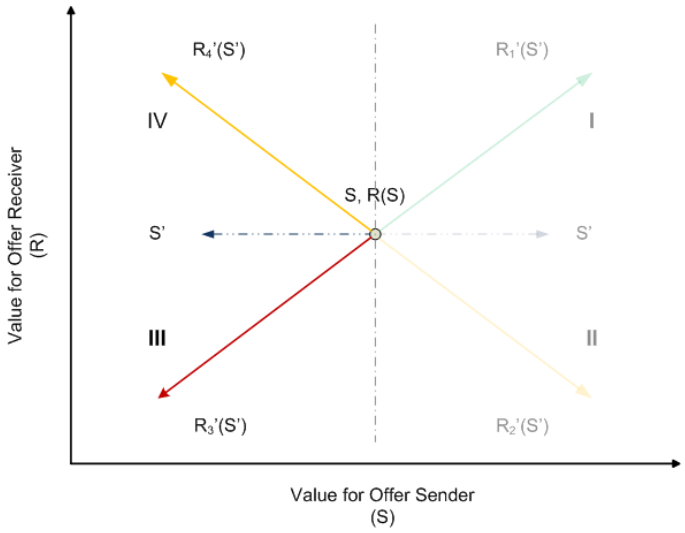


Figure 3.6: Sender's utility decreasing offers, adapted from (Chen 2006, p.8)

ii) In the literature, a concession can be defined as an offer, where the overall utility for the offer sender is lower than in the previous offer (Stuhlmacher and Champagne 2000). In order to avoid misunderstandings, as we also analyze the use of "concession" bargaining steps as classified by Filzmoser and Vetschera (Filzmoser, Vetschera, 2008), we use the term "sender's utility decreasing offers"

instead. In a reasonable negotiation, negotiators have to decrease their overall demand, in order to reach an agreement. To get a deeper insight into the approach of the negotiating parties, the following hypotheses on the subject are examined.

iii) It was found that users with economic decision support are fewer resistant to concede and employ more- but smaller conceding bargaining steps than users of passive support systems (Koeszegi, et al. 2006). Furthermore, negotiators supported with a history graph, as it is implemented in the EDS condition, are more able to cope with the cognitive load to prepare various offer packages where the overall utility can be consistently decreased (Gettinger and Koeszegi 2012). Thus, we predict that the frequency of sender's utility decreasing offers of users with EDS is higher than compared to users with NoDS.

As stated above, the e-mediation support system *vienNA* intends to increase negotiators' flexibility to move from initial positions and it helps to save face when making concessions (Druckman, et al. 2004; Druckman, et al. 2002). We expect that the afore-mentioned arguments contribute to a negotiation atmosphere where negotiators are more willing to decrease their overall demand. Thus, we predict that the frequency of sender's utility decreasing offers of users with BDS is higher than compared to users with NoDS.

As stated above, we expect that both provided decision support systems, EDS and BDS, influence negotiators to make more sender's utility decreasing offers. To compare these two conditions among one another, we need to take a closer look on the expected conceding behavior. On the one hand, users with EDS are expected to focus more on the individual outcome, and thereby on the efficiency of a negotiation (Gettinger, et al. 2012a). On the other hand, users with BDS are more concerned with the facilitation of the negotiation process, and thereby on the effectiveness of a negotiation (Gettinger, et al. 2012a). We anticipate that the aim of the facilitation of the negotiation process (e.g. making concessions in more critical issues in order to reach an agreement) of BDS approach, has a stronger impact on whether negotiators are willing to decrease their own overall utility or not than the EDS approach. Thus, we predict that the frequency of sender's utility decreasing offers of users with BDS, is higher than compared to users with EDS.

In the combined condition EDS+BDS, we expect an intensifying effect as both decision support systems are expected to influence negotiators to propose more sender's utility decreasing offers. Thus, we predict that the frequency of sender's utility decreasing offers of users in the EDS+BDS condition is higher than those of users in any other condition.

In summary, we predict that the frequency of sender's utility decreasing offers of users in the EDS and BDS conditions is higher than compared to users in the NoDS condition. Moreover, we expect that BDS has a stronger positive impact on the subject than EDS, and we anticipate an intensifying effect in the combined condition EDS+BDS, in which users are expected to exchange more sender's utility decreasing offers than compared to users in any other condition. In more detail, hypotheses H_{II}(**2a**)a-f are summarized as follows.

H_{II}(**2a**)a: Negotiators provided with BDS exchange sender's utility decreasing offers more often than those provided with NoDS.

H_{II}(**2a**)b: Negotiators provided with EDS exchange sender's utility decreasing offers more often than those provided with NoDS.

H_{II}(**2a**)c: Negotiators provided with BDS exchange sender's utility decreasing offers more often than those provided with EDS.

H_{II}(**2a**)d: Negotiators provided with EDS+BDS exchange sender's utility decreasing offers more often than those provided with NoDS.

H_{II}(**2a**)e: Negotiators provided with EDS+BDS exchange sender's utility decreasing offers more often than those provided with EDS.

H_{II}(**2a**)f: Negotiators provided with EDS+BDS exchange sender's utility decreasing offers more often than those provided with BDS.

Figure 3.7: Expected relation - frequency of sender's utility decreasing offers

3.2.3 H_{II}(2b) Frequency of receiver’s utility increasing offers

i) A "receiver's utility increasing offer" is (analogously to a sender’s utility decreasing offer) defined as an offer, where the overall utility value for the offer

receiver is higher than in the previous offer. In more detail, a receiver's utility increasing offer takes place, when the offer is made in made in the I or IV quarter, illustrated in Figure 3.8**.**

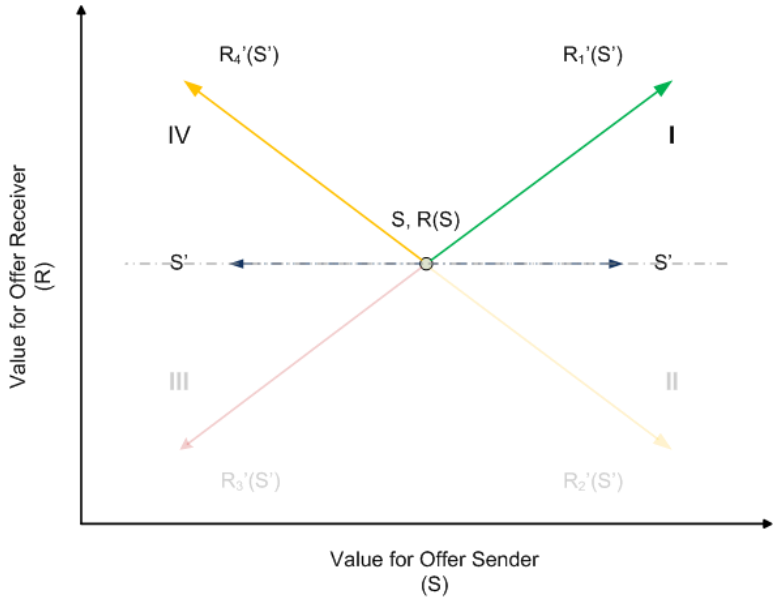


Figure 3.8: Receiver's utility increasing offers, adapted from (Chen 2006, p.8)

ii) The given negotiation case involves a high level of conflict. This implies that even though there are given strictly opposing preferences, a decrease of utility in an issue of one negotiation party, is not automatically coupled with an increase in utility of the other negotiation party. In more detail, the Figure 3.9 illustrates the preferences of the given case in the issue "duration of contract" of both negotiation parties. Using an example, we can see that if Metallurg offers a reduction in the duration of contract from 12 to 9 years, they give in almost 40 points of their utility, while Mihalits' utility remains unchanged. What is more, the figure shows that on the way to the zone of a possible agreement (ZOPA), there are just a few steps where the receiver's utility of an offer is actually increased in this particular issue.

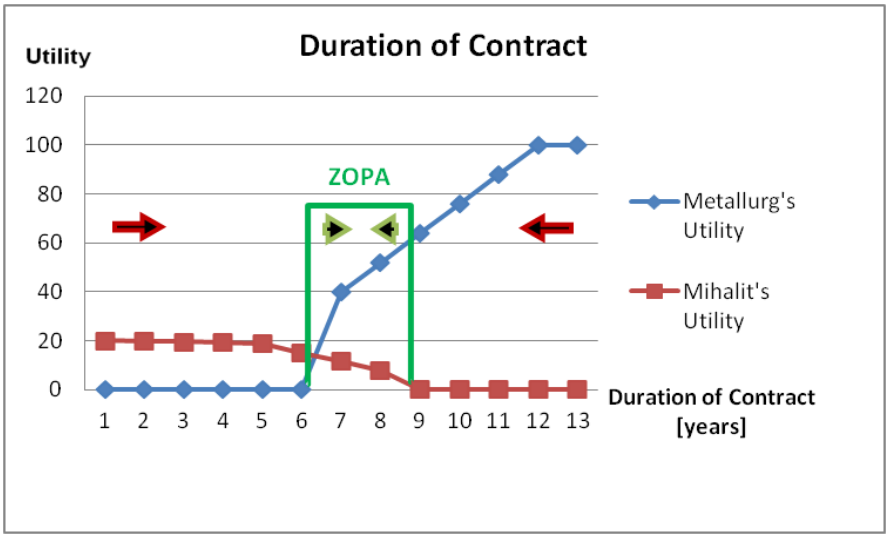


Figure 3.9: Impact of the decrease of the offer sender's utility on the utility of the offer receiver

Furthermore, it was shown that for every offer, there are usually several alternative offer packages where a negotiator is indifferent in his overall utility (Kersten 2010; Kersten and Noronha 1998). In more detail, this means that negotiators can move on their own "indifference curves" and search for mutual beneficial offers, where they do not need to decrease their overall utility value. The example below (see Figure 3.10) shows several alternative offer packages, which present a trade-off between two issues ("salary" and "days" in a job contract), where all offers on a curve yield the same aggregated value.

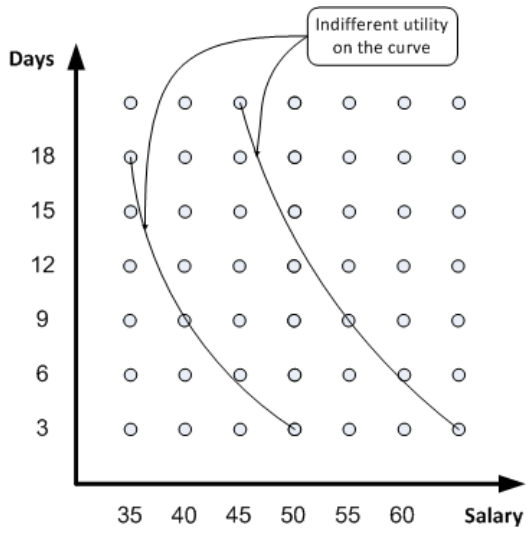


Figure 3.10: Indifference curves, adapted from (Kersten and Noronha 1998, p.5)

All of the above-mentioned facts lead to the conclusion that negotiators need to exchange priority information, in order to propose contracts in which the opponents are actually better off than in the previous offers.
To our best knowledge, the field of "received offers" has not been part of too many studies yet. However, it is of further interest, to test the impact of the applied NSSs on the on the use of offers, where the overall utility of the offer receiver is actually increased.

iii) It was found that negotiators with passive support make fewer, but larger concessions (Koeszegi, et al. 2006). As a consequence, we predict that the probability that the receiver's utility is increased by such a larger concession, is then higher. Furthermore, we anticipate that users provided with EDS are more likely to move along their indifference curves than users with passive support. This can be a heuristic search of trial and error of the offer sender (Stuhlmacher and Champagne 2000), where there is actually no need that the offer receiver's utility is increased. As a consequence of the above-mentioned facts, we anticipate that on the one hand, the larger number- but smaller size of sender's utility decreasing offers in the EDS condition, and on the other hand the larger size- but smaller number of the subject in the NoDS condition, has an equalizing effect on the number of offers where the receiver's utility is increased. Thus, we expect that there is no significant difference in the frequency of receiver's utility increasing offers between users with EDS and users with NoDS.

The e-mediation support system *vienNA* intends to increase the exchange of priority information, and therefore aims to increase the understanding for the opponents' preferences (Druckman, et al. 2004; Druckman, et al. 2002). We anticipate that a higher understanding of the opponents' needs leads to more offers where the receiver's utility is increased. Thus, we expect that the frequency of offers where the receiver's overall utility is superior to the previous offer, of users in the BDS condition is higher than those of users in the NoDS condition, and thereby also higher than those of users in the EDS condition.

In the combined condition EDS+BDS, as we predict that BDS has an increasing influence and EDS has in total no significant impact on the subject, it is expected that users will exchange relatively more receiver's utility increasing offers than

compared to users with EDS and NoDS, but they will not differ significantly in the subject compared to users with BDS.

In summary, we predict that users in the BDS and EDS+BDS condition will exchange relatively more receiver's utility increasing offers than compared to users with EDS and users with NoDS. Furthermore, we expect no significant difference in the subject between users with BDS and users with EDS+BDS. In more detail, hypotheses H_{II}(**2b**)a-f are summarized as follows.

H_{II}(**2b**)a: Negotiators provided with BDS exchange receiver's utility increasing offers more often than those provided with NoDS.

H_{II}(**2b**)b: Negotiators provided with EDS exchange receiver's utility increasing offers similarly often to those provided with NoDS.

H_{II}(**2b**)c: Negotiators provided with BDS exchange receiver's utility increasing offers more often than those provided with EDS.

H_{II}(**2b**)d: Negotiators provided with EDS+BDS exchange receiver's utility increasing offers more often than those provided with NoDS.

H_{II}(**2b**)e: Negotiators provided with EDS+BDS exchange receiver's utility increasing offers more often than those provided with EDS.

H_{II}(**2b**)f: Negotiators provided with EDS+BDS exchange receiver's utility increasing offers similarly often to those provided with BDS.

EDS+BDS = BDS > EDS = NoDS

Figure 3.11: Expected relation - frequency of receiver's utility increasing offers

3.2.4 H_{II}(3a) Average size of sender's utility decreasing offer

i) The size of a sender's utility decreasing offer is the difference in the offer sender's decreased overall utility rating between two subsequent offers.

ii) The average size of sender's utility decreasing offers (known in literature as the average size of an individual concession (Stuhlmacher and Champagne 2000) is known as a another main characteristic of negotiations (Koeszegi and Vetschera 2010), as it indicates the approach of negotiators towards each other.

Thus, it is of further interest, how the applied NSSs influence the behavior of negotiators, when they move away from initial positions and decrease their own utility value.

iii) The e-mediation support system *vienNA* intends to increase negotiators' flexibility to move from initial positions and to enhance the exchange of priority information (Druckman, et al. 2004; Druckman, et al. 2002). As we expected in hypothesis $H_{\mathbf{I}}(\mathbf{2})$a that a higher exchange of priority information results in a smaller number of proposed contracts, we anticipate that the conceding size per offer is then higher. Thus, we predict that the average size of sender's utility decreasing offers of users with BDS is greater than those of users with NoDS.

It was found that users with EDS exchange relatively fewer task specific information than users with NoDS(Koeszegi, et al. 2006). Thereby, negotiators focus more on the maximization of the own utility and employ more- but smaller conceding steps than users with passive support. Thus, we expect that the average size of a sender's utility decreasing offer of users with EDS is significantly smaller than compared to users with NoDS, and thereby also smaller than compared to users with BDS.

In the combined condition EDS+BDS, we anticipate that on the one hand, the provided advice of BDS to exchange more task-related information (and therefore use a greater conceding size per offer) and on the other hand, the focus on the own utility ratings of EDS (which should lead to smaller conceding steps), have an equal strong, but opposed impact on the subject. Thus, we predict that there is no significant difference in the average size of sender's utility decreasing offers between users of EDS+BDS and those with NoDS.

In summary, we expect that average size of sender's utility decreasing offers of users with NoDS is relatively smaller than compared to users with BDS, but greater than those of users with EDS. Thereby, we anticipate an equalizing effect on the subject in the combined condition EDS+BDS, where no significant difference in the average size of sender's utility decreasing offers between users in this condition and users in the NoDS condition is expected. In more detail, hypotheses $H_{\mathbf{II}}(\mathbf{3a})$a-f are summarized as follows.

H_{II}(**3a**)a: Negotiators provided with BDS exchange on average bigger sender's utility decreasing offers than those provided with NoDS.

H_{II}(**3a**)b: Negotiators provided with EDS exchange on average smaller sender's utility decreasing offers than those provided with NoDS.

H_{II}(**3a**)c: Negotiators provided with BDS exchange on average bigger sender's utility decreasing offers than those provided with EDS.

H_{II}(**3a**)d: Negotiators provided with EDS+BDS exchange sender's utility decreasing offers with an on average similar size to those provided with NoDS.

H_{II}(**3a**)e: Negotiators provided with EDS+BDS exchange on average bigger sender's utility decreasing than those provided with EDS.

H_{II}(**3a**)f: Negotiators provided with EDS+BDS exchange on average smaller sender's utility decreasing than those provided with BDS.

BDS > NoDS = EDS+BDS > EDS

Figure 3.12: Expected relation - average size of sender's utility decreasing offers

3.2.5 H_{II}(3b) Average size of receiver's utility increasing offers

i) The size of a receiver's utility increasing offer is the difference in the offer receiver's increased overall utility between two subsequent offers.

ii) Analogue to the frequency of receiver's utility increasing offers, the average size of receiver's utility increasing offers has, to our best knowledge, not received significant empirical attention yet. However, the variable is expected to be a suitable measure for the understanding of the counterparts' preferences. Thus, the following hypotheses to the subject are examined.

iii) The e-mediation support system *vienNA* intends to enhance the exchange of priority information, and thereby, is expected to increase the understanding of negotiators for each others' needs (Druckman, et al. 2004). We anticipate that a higher understanding for each others' needs, leads to an offer exchange process, where an appropriate reduction in the utility from the offer sender does actually lead to an increase in the utility for the offer receiver (see Figure 3.9). Thus, we

expect that the average size of receiver's utility increasing offers of users with BDS is higher than compared to users with NoDS.

As mentioned above, users with EDS send more- but smaller demand decreasing offers than users with NoDS (Koeszegi, et al. 2006). Furthermore, we predict that users with EDS, as they focus on the maximization of their own utility, do more often try to search for mutual gains when they move on their indifference curves, which is not necessarily coupled with an increase of utility rating for the opponent. Thus, we predict that the average size of receiver's utility increasing offers of users with EDS is significantly smaller than compared to users with NoDS and thereby also significantly smaller than those of users with BDS.

In the combined condition EDS+BDS, we predict that on the one hand , the intention of EDS to maximize the own utility, and on the other hand, the aim of BDS to pay more attention to the needs of the opponent, has a somewhat equalizing effect on the subject. Thus, we expect that there is no significant difference in the average size of receiver's utility increasing offers of users in this condition compared to users with NoDS. As a consequence, we anticipate that the average size of receiver's utility increasing offers of users with EDS+BDS is significantly higher than compared to users with EDS, and significantly lower than compared to users with BDS.

In summary, we expect that the average size of receiver's utility increasing offers of users in the BDS condition is higher than compared to users in any other condition. Moreover, we predict that there will be no significant difference in the subject between users with EDS+BDS and users with NoDS. In addition, we anticipate that the average size of receiver's utility increasing offers of users with EDS+BDS is higher than compared to users with only EDS. In more detail, hypotheses H_{II}(**3b**)a-f are summarized as follows.

H_{II}(**3b**)a: Negotiators provided with BDS exchange on average bigger receiver's utility increasing offers than those provided with NoDS.

H_{II}(**3b**)b: Negotiators provided with EDS exchange on average smaller receiver's utility increasing offers than those provided with NoDS.

H_{II}(**3b**)c: Negotiators provided with BDS exchange on average bigger receiver's utility increasing offers than those provided with EDS.

H_{II}(**3b**)d: Negotiators provided with EDS+BDS exchange receiver's utility increasing offers with an on average similar size to those provided with NoDS.

H_{II}(**3b**)e: Negotiators provided with EDS+BDS exchange on average bigger receiver's utility increasing than those provided with EDS.

H_{II}(**3b**)f: Negotiators provided with EDS+BDS exchange on average smaller receiver's utility increasing than those provided with BDS.

BDS > NoDS = EDS+BDS > EDS

Figure 3.13: Expected relation - average size of receiver's utility increasing offers

3.2.6 H_{II}(4) Ratio of unconditional and total concession size

Change of demand in issue			Step type
Decrease	No change	Increase	
x			Concession
x	x		Concession
	x		Insistence
		x	Demand
	x	x	Demand
x		x	Trade-off
x	x	x	Trade-off

Figure 3.14: Conditional and unconditional concessions, adapted from (Filzmoser and Vetschera, 2008 p.425)

i) A conditional concession is defined, as the decrease of the offer sender's utility when employing a trade-off step (see the red crosses in Figure 3.14). On the other hand, an unconditional concession is the decrease of the offer sender's utility when a concession step is used (green crosses in Figure 3.14).

ii) The observation of the relation between conditional and unconditional concessions belongs to the more recent studies in negotiation analysis (Filzmoser and Vetschera 2008; Gettinger, et al. 2012b; Koeszegi, et al. 2006). In the

foregone sets of hypotheses, we have just focused on whether the utility of users was decreased or not, but we did not observe if the approach towards each other was made in either using conditional or unconditional concessions. To get a more detailed view on this particular negotiation process, the focus of the following hypotheses is on the comparison if the decreased utility size will be made in either concession, or trade-off steps.

iii) It was found that users with passive support "compensate for the lack of support in multi-issue offer construction to some extent by explicitly suggesting trade-offs" (Koeszegi, et al. 2006; p.23). Concerning the graphical support in *Negoisst*, it was found that users supported with a history graph, use significantly more unconditional concessions in critical issues (Gettinger, et al. 2012b). All of the above-mentioned facts contribute to the expectation that the ratio of the unconditional and total concession size of users with NoDS is significantly lower than those of users with EDS.

The e-mediation support system *vienNA*, addresses negotiators with tactical advice to search for mutually beneficial trade-offs (Druckman, et al. (2004). Furthermore, it was shown that tactical advice influences the behavior of negotiators (Weingart, et al. 1996), which should then lead to the mere use of trade-offs of users with BDS. Thus, we predict that the ratio of unconditional and total concession size of users with BDS is significantly lower than those of users with NoDS, and thereby also significantly lower than those of users with EDS.

In the combined condition EDS+BDS, we predict that the tactical advice of BDS to consider the use of trade-offs, has an equalizing impact on the expected use of more unconditional concessions of users provided with EDS. Thus, we expect that there is no significant difference in the ratio of unconditional and total concession size between users with EDS+BDS and users with NoDS. Furthermore, we then predict that users with EDS+BDS use a lower unconditional to total concession size than users with EDS, but still show a higher characteristic in the subject than compared to users with BDS.

In summary, we expect that the ratio of unconditional and total concession size of users in the BDS condition is lower than compared to users in any other condition. Moreover, we expect that there will be no significant difference in the

subject between users with EDS+BDS and users with NoDS, and both conditions will show a lower characteristic in the subject than compared to users with EDS only. In more detail, hypotheses H_{II}(**4**)a-f are summarized as follows.

H_{II}(**4**)a: Negotiators provided with BDS will use a lower ratio of unconditional and total concession size than those provided with NoDS.

H_{II}(**4**)b: Negotiators provided with EDS will use a higher ratio of unconditional and total concession size than those provided with NoDS.

H_{II}(**4**)c: Negotiators provided with EDS will use a higher ratio of unconditional and total concession size than those provided with BDS.

H_{II}(**4**)d: Negotiators provided with EDS+BDS will use a similar ratio of unconditional and total concession size to those provided with NoDS.

H_{II}(**4**)e: Negotiators provided with EDS+BDS will use a lower ratio of unconditional and total concession size than those provided with EDS.

H_{II}(**4**)f: Negotiators provided with EDS+BDS will use a higher ratio of unconditional and total concession size than those provided with BDS.

EDS > NoDS = EDS+BDS > BDS

Figure 3.15: Expected relation - ratio of unconditional and total concession size

3.3 H_{III} - Offer Quality

The first and the second part of hypotheses covered the impact of the applied NSSs on the offer exchange on an individual basis, as the offer sender and offer receiver were treated separately. To gain a joint perspective, the third part analyses the effect on both, offer sender and receiver, together. Therein, we investigate, how the applied NSSs aid negotiators on the way to make the "right" concessions (Gettinger, et al. 2012a).

3.3.1 H_{III}(1) Frequency of sender's utility decreasing offers with a positive joint value

i) A sender's utility decreasing offer with a positive joint value, is defined as an offer, where the utility of the offer sender is decreased and the joint value for

the offer sender and receiver is greater than 0. In more detail, this means that the receiver's win in utility has to be greater than the sender's loss in utility. Using the example illustrated in Figure 3.9- when Mihalits offers a longer duration from 7 to 8 years to Metallurg, the increase of the utility of Metallurg is higher than the decrease of the utility of Mihalits, which then results in a sender's utility decreasing offer with a positive joint value for both negotiators. In more detail, a sender's utility decreasing offer with a positive joint value takes place, when it is made in the green triangularly space illustrated in Figure 3.16.

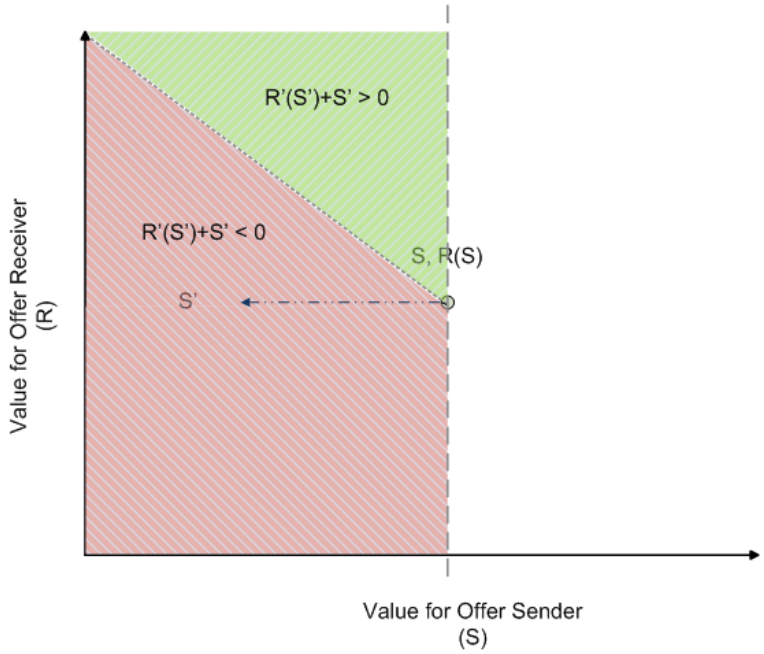


Figure 3.16: Sender's utility decreasing offers with a positive joint value

ii) The joint value of exchanged offers for the offer sender and offer receiver, serves to differentiate between integrative, distributive and destructive concession types (Bosse, et al. 2004; Chen 2006). As mentioned above, there are strictly opposing preferences in the given negotiation case of the experiment. Therefore, we focus on whether the joint value of a sender's utility *decreasing*[2] offer is positive or negative. The subject shall represent an indicator for the support of negotiators to prepare offers of high quality. Thus, the impact of the applied NSSs on this issue is examined in the following hypotheses.

iii) As stated above the e-mediation system *vienNA* intends to enhance negotiators' ability to understand opponents' perspectives and gives tactical advice

[2] In the conducted experiment, the number of sender's utility *increasing* offers was not sufficient to be tested, so we had to focus on sender's utility *decreasing* offers

to engage in value creating offers (Druckman, et al. 2004; Druckman, et al. 2002). As a better knowledge of opponent's preferences and needs is expected to lead to more value creating offers, we predict that the frequency of sender's utility decreasing offers with a positive joint value of users with BDS is higher than those of users with NoDS.

It was found that users with economic decision support use more, but smaller concession steps (Koeszegi, et al. 2006). Furthermore, the focus of EDS is on the maximization of the own individual utility (Gettinger, et al. 2012a; Gettinger and Koeszegi 2012). In addition it was discovered that users with such support reach a better joint outcome, which is then the consequence of the more frequent use of offers, where the joint value is increased (Rangaswamy and Shell 1997). Moreover, we predict that the awareness of the own preferences makes it easier for users with EDS to prepare various offer packages and discover new solutions with a higher joint value. Thus, we expect that the frequency of sender's utility decreasing offers with a positive joint value of users with EDS is significantly higher than those of users with NoDS.

As stated above, both provided decision support systems EDS and BDS, are expected to increase the frequency of sender's utility decreasing offers with a positive joint value. To compare these two conditions among one another, we need to take a closer look on the provided support. On the one hand, users with EDS are expected to show a higher awareness of their own preferences, while on the other hand, users with BDS are expected to have a better understanding of each others' preferences. We anticipate that the cognitive ease of application of users with EDS leads to more offer-packages where the offer sender's utility can be decreased in smaller steps. We then predict that a mere use of such offers will result in more sender's utility decreasing offers with a positive joint value, where possible gains are not left on the bargaining table. Thus, we expect that the frequency of sender's utility decreasing offers with a positive joint value of users with EDS is significantly higher than those of users with BDS.

In the combined condition EDS+BDS, we expect an intensifying effect on the subject, as both, the awareness of the own preferences, and the understanding of the opponents' actual needs, are expected to contribute to a higher frequency of sender's utility decreasing offers with a positive joint value. Thus, we predict that

the frequency of sender's utility decreasing offers with a positive joint value of users with EDS+BDS is significantly higher than compared to users in any other condition.

In summary, we expect that the frequency of sender's utility decreasing offers with a positive joint value of users in the EDS and BDS conditions, is higher than compared to users in the NoDS condition. Moreover, we predict that EDS has a stronger increasing impact on the subject than BDS, and we anticipate an intensifying effect in the combined condition EDS+BDS, in which users are expected to exchange more sender's utility decreasing offers with a positive joint value than compared to users in any other condition. In more detail, hypotheses H_{III}**(1)**a-f are summarized as follows.

H_{III}**(1)**a: Negotiators provided with BDS exchange sender's utility decreasing offers with a positive joint values more often than those provided with NoDS.

H_{III}**(1)**b: Negotiators provided with EDS exchange sender's utility decreasing offers with a positive joint values more often than those provided with NoDS.

H_{III}**(1)**c: Negotiators provided with EDS exchange sender's utility decreasing offers with a positive joint values more often than those provided with BDS.

H_{III}**(1)**d: Negotiators provided with EDS+BDS exchange sender's utility decreasing offers with a positive joint values more often than those provided with NoDS.

H_{III}**(1)**e: Negotiators provided with EDS+BDS exchange sender's utility decreasing offers with a positive joint values more often than those provided with EDS.

H_{III}**(1)**f: Negotiators provided with EDS+BDS exchange sender's utility decreasing offers with a positive joint values more often than those provided with BDS.

Figure 3.17: Expected relation - frequency of sender's utility decreasing offers with a positive joint value

3.4 H_{IV} - Outcome Analysis

The first three parts of hypotheses focused on the negotiation process, as they covered the impact of the applied NSSs on the offer exchange during the progress of the negotiation. In the fourth part, we will analyze the impact of the applied NSSs on the outcome of a negotiation. Therein, we investigate three prominent outcome measures: i) the probability to reach an agreement (effectiveness of a negotiation), ii) the joint utility (efficiency), and iii) the contract (im)balance (fairness) of an agreement.

3.4.1 H_{IV}(1) Rate of Agreements

i) The rate of agreements is defined as the relation of the number of negotiations which reached an agreement, to the total number of conducted negotiations.

ii) The rate of agreements is a common characteristic in negotiation analysis, as it represents the effectiveness of a negotiation. The main goal of a negotiation is to reach an agreement which is feasible and does not violate any reservation levels of both negotiation parties. Thus, the impact of the applied NSSs on the subject is examined in the following hypotheses.

iii) It was found that users with economic decision support reach more agreements than users without this type of support (Koeszegi, et al. 2006; Wilkenfeld, et al. 1995). Compelling evidence for this phenomenon was found in the particular concession behavior of users with EDS, as users in this condition "make more use of package negotiation instead of issue isolation, are fewer resistant to concession making and yielding, […] than users of passive systems. Altogether, these differences in behavior result in more agreements" (Koeszegi, et al. 2006, p. 28). Thus, we expect that users with EDS reach more agreements than users with NoDS.

E-mediation support intends to increase the willingness of negotiators to move from initial positions and to sacrifice in critical issues. Thereby, it increases the prospects to reach an agreement, as it helps users to overcome possible impasses or stalemates in a negotiation (Druckman, et al. 2004). Thus, we predict that the rate of agreements of users with BDS is significantly higher than those of users with NoDS.

As stated above, both provided decision support systems EDS and BDS, are expected to increase the probability of negotiators to reach an agreement. To compare these two conditions among one another, we need to take a closer look on the provided support. On the one hand, users with EDS are expected use a consistent concession pattern and are more focused on the maximization of the own utility. On the other hand, BDS gives advice on how to move from initial positions and helps negotiators to discover new solutions (Druckman, et al. 2004; Druckman, et al. 2002). We expect that the behavioral support to save face when making concessions (especially in critical issues), has a stronger impact on the probability that negotiators reach an agreement than a consistent concession behavior, where both negotiating parties concede rather slowly towards each other. Thus, we predict that users with BDS reach more agreements than users with EDS.

In the combined condition EDS+BDS, we anticipate an intensifying effect for the subject, as both decision support systems are expected to increase the probability to reach an agreement. Thus, we predict that users in the EDS+BDS condition reach more agreements than users in any other condition.

In summary, it is expected that users in both conditions EDS and BDS, reach more agreements than compared to users with NoDS. Moreover, we predict that BDS has a stronger increasing impact on the subject than EDS, and we anticipate an intensifying effect in the combined condition EDS+BDS, in which users are supposed to reach more agreements than compared to users in any other condition. In more detail, hypotheses $H_{\mathbf{IV}}(\mathbf{1})$a-f are summarized as follows.

$H_{\mathbf{IV}}(\mathbf{1})$a: Negotiators provided with BDS are more likely to reach an agreement than those provided with NoDS.

$H_{\mathbf{IV}}(\mathbf{1})$b: Negotiators provided with EDS are more likely to reach an agreement than those provided with NoDS.

$H_{\mathbf{IV}}(\mathbf{1})$c: Negotiators provided with BDS are more likely to reach an agreement than those provided with EDS.

$H_{\mathbf{IV}}(\mathbf{1})$d: Negotiators provided with EDS+BDS are more likely to reach an agreement than those provided with NoDS.

H_{IV}**(1)**e: Negotiators provided with EDS+BDS are more likely to reach an agreement than those provided with EDS.

H_{IV}**(1)**f: Negotiators provided with EDS+BDS are more likely to reach an agreement than those provided with BDS.

Figure 3.18: Expected relation - rate of agreements

3.4.2 H_{IV}(2) Joint Utility

i) The joint utility of an agreement is defined " by summing the number of points reached by each negotiator; the higher the value of the joint points, the higher the joint utility" (Delaney, et al. 1997).

ii) The joint utility of a negotiation is a common test characteristic in negotiation analysis, and has therefore been part of many prior studies (Delaney, et al. 1997; Foroughi, et al. 1995; Gettinger, et al. 2012a; Perkins, et al. 1996; Rangaswamy and Shell 1997). As the subject indicates the efficiency of a negotiation (Gettinger, et al. 2012a), we examine the impact of the applied NSSs on the issue in the following hypotheses.

It was found that users supported with tactical advice reach higher joint outcomes than users without that support (Weingart, et al. 1996). The e-mediation system *vienNA* provides tactical advice to employ integrative logrolling offers, and helps negotiators to understand each others' preferences (Druckman, et al. 2004; Druckman, et al. 2002). Thereby, we anticipate that negotiators can then more easily realize joint gains than users without such support. Thus, we predict that the joint utility of users with BDS is significantly higher than those with NoDS.

It was shown that users with economic decision support reach a better joint outcome than users without such support (Delaney, et al. 1997; Gettinger, et al. 2012a; Perkins, et al. 1996; Rangaswamy and Shell 1997). As stated above, the focus of economic decision support is on the maximization of the own individual utility, and therefore on the efficiency of a negotiation (Gettinger, et al. 2012a). We anticipate that negotiators will then be more aware of their own needs and interests, and both parties will try to maximize their utility according to their own

preferences. As a consequence, we then expect a higher individual utility of both negotiating parties and we predict also a higher joint utility for both parties in the final contract. Thus, we anticipate that the joint utility of users with EDS is then higher than those of users with NoDS.

As stated above, both provided decision support systems EDS and BDS, are expected to increase the joint utility of an agreement. To compare these two conditions among one another, we need to take a closer look on the provided support. On the one hand, users with EDS are more focused on the efficiency of a negotiation and therefore on the maximization of their own utility. On the other hand, users with BDS focus more on the effectiveness of negotiation, and thereby enhance the probability to reach an agreement at all. We anticipate that the expected consistent concession behavior of users with EDS, will lead to more offers where both negotiators try to maximize their own individual utility value. On the other hand, we expect that users with BDS are more concerned to reach an agreement, and thereby, potentially, leave some value on the bargaining table. Thus, we expect that the joint utility of an agreement of users with EDS is significantly higher than those of users with BDS.

In the combined condition, we predict an intensifying effect on the subject. On the one hand, the expected minimization of the individuals' losses due to the awareness of the own preferences, and on the other hand, the understanding of the opponents' actual needs, is expected to help negotiators to realize more joint gains than compared to users to which either EDS, BDS or NoDS is available. Thus, we predict that joint utility of users with EDS+BDS is significantly higher than compared to users in any other condition.

In summary, we expect that the joint utility of users in both conditions EDS and BDS is higher than compared to those with NoDS. Moreover, we predict that EDS has a stronger increasing impact on the subject than BDS, and we anticipate an intensifying effect in the combined condition EDS+BDS, in which users reach a higher joint utility than compared to users in any other condition. In more detail, hypotheses $H_{\mathbf{IV}}(\mathbf{2})$a-f are summarized as follows.

$H_{\mathbf{IV}}(\mathbf{2})$a: Negotiators provided with BDS reach a higher joint utility in the final agreement than those provided with NoDS.

H_{IV}(2)b: Negotiators provided with EDS reach a higher joint utility in the final agreement than those provided with NoDS.

H_{IV}(2)c: Negotiators provided with EDS reach a higher joint utility in the final agreement than those provided with BDS.

H_{IV}(2)d: Negotiators provided with EDS+BDS reach a higher joint utility in the final agreement than those provided with NoDS.

H_{IV}(2)e: Negotiators provided with EDS+BDS reach a higher joint utility in the final agreement than those provided with EDS.

H_{IV}(2)f: Negotiators provided with EDS+BDS reach a higher joint utility in the final agreement than those provided with BDS.

Figure 3.19: Expected relation - joint utility

3.4.3 H_{IV}(3) Contract Imbalance

i) The contract imbalance is defined "as the absolute value of the difference between the number of points achieved by each bargainer" (Delaney, et al. 1997).

ii) The contract imbalance of an agreement is a common test in negotiation analysis. The subject indicates the "fairness" of a negotiation (Foroughi, et al. 1995). Thus, the impact of the applied NSSs on this issue is examined in the following hypotheses.

iii) It was found that users with e-mediation support, perceived agreements as more balanced than negotiators without this support (Druckman, et al. 2004). Moreover, we expect that the provided flexibility grid in *vienNA* (which visualizes the approach of the negotiators in critical issues to both parties) leads to more counterbalanced agreements. Thus, we predict that users with NoDS reach more imbalanced agreements than users with BDS.

It was found that users with economic decision support reach more balanced agreements than users without that support (Delaney, et al. 1997; Foroughi, et al. 1995). Therein, it was expected that the higher awareness of the own preferences and the particular utility for different offer packages, will “help each bargainer

find a contract alternative which he feels is fair both for himself and for his partner and which he can accept without losing face"(Foroughi, et al. 1995, p. 495). Thus, we expect that users with NoDS reach more imbalanced agreements than users with EDS.

As stated above, both provided decision support systems EDS and BDS, are expected to reach more balanced agreements than users with NoDS. To compare these two conditions among one another, we need to take a closer look on the provided support. On the one hand, users with EDS are always aware of the utility ratings for different offer packages, and can therefore more easily search for a mutual beneficial solution. On the other hand, BDS helps negotiators to identify the flexibility in critical issues and displays whether a fair agreement is expected to be reached or not (Druckman, et al. 2004; Druckman, et al. 2002). We anticipate that the symmetrical support in the BDS condition (via the display of the flexibility of the negotiators to both parties) has a stronger balancing impact on the counterbalance of an agreement than the asymmetric support of users in EDS (via the calculation of the utility of sent and received offers under the preferences of the focal negotiator), because the flexibility grid shows to negotiators whether they are on the way to reach a fair agreement or not. We then anticipate that the goal to reach a more counterbalanced and fairer agreement is more present to users with such support. As a consequence, we predict that users with EDS reach more imbalanced agreements than users with BDS.

In the combined condition EDS+BDS we anticipate an intensifying effect for the subject, as both decision support systems are expected to lead to more counterbalanced agreements. Thus, we predict that users in the EDS+BDS condition reach fewer imbalanced agreements than users in any other condition.

In summary, we expect that users in both conditions EDS and BDS reach fewer imbalanced agreements than compared to those with NoDS. Moreover, we predict that BDS has a stronger balancing impact on the subject than EDS, and we anticipate an intensifying effect in the combined condition EDS+BDS, in which users are expected to reach fewer imbalanced agreements than compared to users in any other condition. In more detail, $H_{\mathbf{IV}}(\mathbf{3})$a-f are summarized as follows.

H_{IV}(**3**)a: Negotiators provided with NoDS reach more imbalanced agreements than those provided with BDS.

H_{IV}(**3**)b: Negotiators provided with NoDS reach more imbalanced agreements than those provided with EDS.

H_{IV}(**3**)c: Negotiators provided with EDS reach more imbalanced agreements than those provided with BDS.

H_{IV}(**3**)d: Negotiators provided with EDS+BDS reach fewer imbalanced agreements than those provided with NoDS.

H_{IV}(**3**)e: Negotiators provided with EDS+BDS reach fewer imbalanced agreements than those provided with EDS.

H_{IV}(**3**)f: Negotiators provided with EDS+BDS reach fewer imbalanced agreements than those provided with BDS.

Figure 3.20: Expected relation - contract imbalance

3.5 H_V - Offer Analysis in the pre- and post *vienNA* condition

The foregone parts of hypotheses covered the impact of the applied NSSs on the negotiation process and outcome. The following and last part analyzes the impact of the behavioral decision support system on the performance of negotiators in more detail. Therein, we investigate i) the sender's utility decreasing size per bargaining step, and ii) ratio of the unconditional and total concession size, before (pre-*vienNA*) and after (post-*vienNA*) the use of *vienNA*.

3.5.1 H_V(1) Sender's utility decreasing size per bargaining step

i) The "sender's utility decreasing size per bargaining step" is defined as the total decreased utility value of a negotiator during the negotiation, divided by the number of the used bargaining steps.

ii) We compare the differences in the sender's utility decreasing size per bargaining step between the pre- and post-*vienNA* phase, in order to get a deeper insight into the intensity of the offer exchange, before- and after the first use of *vienNA*. As stated in the foregone hypotheses, it is expected that there is an influence of different support systems on the number of proposed contracts and the size of made concessions. Thus, the impact of the applied NSSs on the sender's utility decreasing size per bargaining step is analyzed in more detail in the following hypotheses.

iii) As it was mentioned above, it is expected that the use of *vienNA* increases the amount of exchanged priority information and aids negotiators to enhance task-related communication (Druckman, et al. 2004). In hypotheses $H_{\mathbf{I}}(\mathbf{2})$a-f, concerning the number of proposed contracts within a negotiation, we predicted that the mere exchange of priority information results in a smaller number of offers, and helps to overcome possible impasses or stalemates. As a consequence, we expect that the consequent approach of negotiators towards each other will then proceed more fluently. Thus, we expect that in both conditions EDS+BDS and BDS, the sender's utility decreasing size per bargaining step is higher in the post-*vienNA* phase than compared to the pre-*vienNA* phase.

To compare the performance of users with EDS+BDS and users with BDS, in the post-*vienNA* phase, we take a look on the expected impact of economic decision support. As it was stated in the foregone hypotheses, users with additional EDS are expected to use more- but smaller concessions than users to which this support is not available (Koeszegi, et al. 2006), which then consequently results in a smaller sender's utility decreasing size per bargaining step. Thus, we predict that the sender's utility decreasing size per bargaining step in the post-*vienNA* phase of users with EDS+BDS is smaller than those of users with BDS. In more detail, hypotheses $H_{\mathbf{V}}(\mathbf{1})$a-c, are summarized as follows.

$H_{\mathbf{V}}(\mathbf{1})$a: Negotiators provided with EDS+BDS will use a higher sender's utility decreasing size per bargaining step in the post-*vienNA* phase than compared to the pre-*vienNA* phase.

H_V(**1**)b: Negotiators provided with BDS will use a higher sender's utility decreasing size per bargaining step in the post-*vienNA* phase than compared to the pre-*vienNA* phase.

H_V(**1**)c: In the post-*vienNA* phase, negotiators provided with BDS will use a higher sender's utility decreasing size per bargaining step than those provided with EDS+BDS.

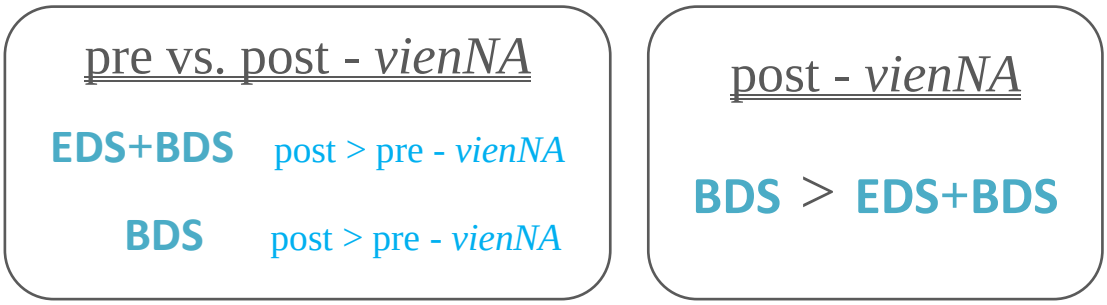


Figure 3.21: Expected relation - pre/post and post/post - *vienNA* comparison of the sender's utility decreasing size per bargaining step

3.5.2 H_V(2) Ratio of unconditional and total concession size

i) Conditional and unconditional concession are defined (analogously to the set of hypotheses H_{II}(2)), as concessions made in either using a "trade-off" or a "concession" bargaining step.

ii) We compare the differences in the relation between conditional and unconditional concessions in the pre- and post *vienNA* phase, in order to get a more detailed view on the variety of used bargaining steps, before- and after the first use of *vienNA*. As we mentioned in the foregone hypotheses, we expect an influence of different support systems on the use of conditional concessions. Thus, the impact of the applied NSSs on the subject is analyzed in more detail in the following hypotheses.

iii) As stated above, *vienNA* addresses users with tactical advice to engage in the search of value creating trade-off offers (Druckman, et al. 2004). Moreover, it was found that tactical advice influences the behavior of negotiators (Weingart, et al. 1996), which is then expected to lead to the mere use of conditional concessions after the use of *vienNA*. As a consequence, we predict that negotiators in both conditions EDS+BDS and BDS, will use a lower ratio of unconditional

and total concession size in the post-*vienNA* phase than compared to the pre-*vienNA* phase.

To compare the relation between conditional and unconditional made concessions of users with EDS+BDS and users with BDS in the post-*vienNA* phase, we take a look on the expected impact of economic decision support. It was found that users without economic decision support, "compensate for the lack of support in multi-issue offer construction to some extent by explicitly suggesting trade-offs" (Koeszegi, et al. 2006; p. 23). Thus, we expect that, even though both conditions are recommended by *vienNA* to use trade-offs, the ratio of unconditional and total concession size in the post-*vienNA* phase of users with BDS is still lower than those of users with EDS+BDS. In more detail, hypotheses H_V(**2**)a-c, are summarized as follows.

H_V(**2**)a: Negotiators provided with EDS+BDS will use a lower ratio of unconditional and total concession size in the post-*vienNA* phase than compared to the pre-*vienNA* phase.

H_V(**2**)b: Negotiators provided with BDS will use a lower ratio of unconditional and total concession size in the post-*vienNA* phase than compared to the pre-*vienNA* phase.

H_V(**2**)c: In the post-*vienNA* phase, negotiators provided with BDS will use a lower ratio of unconditional and total concession size than those provided with EDS+BDS.

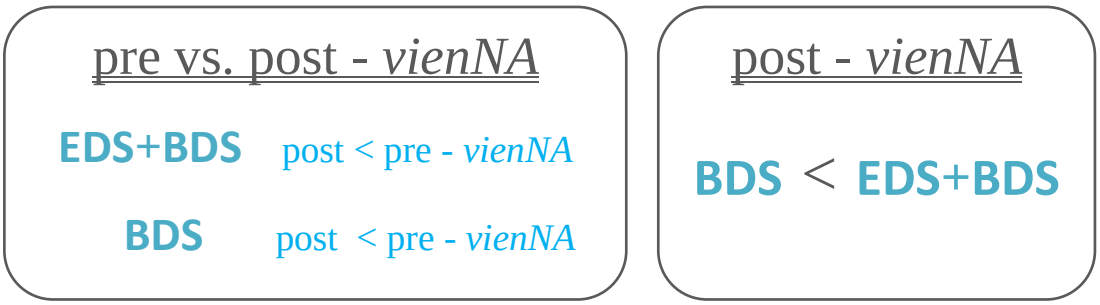


Figure 3.22: Expected relation - pre/post and post/post - *vienNA* comparison of the ratio of unconditional and total concession size

4 Methodology

4.1 Experiment

To evaluate the impact of different support philosophies on e-negotiation process and outcome dimensions, a controlled laboratory experiment was conducted by the University of Hohenheim (Germany), the University of Tilburg (The Netherlands), the University of Vienna (Austria), and the Department of Labor Science and Organization at the Vienna University of Technology.

In the experiment, 228 undergraduate and graduate students with different academic background participated, and were allocated to a 2x2 symmetric design. We summarize their country of origin in Figure 4.1.

Country	N	Country	N	Country	N	Country	N
Albania	1	Finland	5	Ivory Coast	1	Slovakia	4
Austria	28	France	7	Kazakhstan	2	Suriname	1
Azerbaijan	1	Germany	27	Kyrgyzstan	1	Sweden	3
Belarus	1	Hungary	4	Marco	1	The Netherlands	79
Bosnia Herzegovina	2	Iceland	1	Nicaragua	1	Ukraine	3
Bulgaria	2	Indonesia	1	Poland	3	United Kingdom	1
China	1	Iraq	1	Portugal	1	Unknown	29
Croatia	1	Iran	4	Romania	5		
Egypt	1	Italy	3	Russia	2		

Figure 4.1: Participants' country of origin

The different treatment groups were all provided with communication and documentation support via *Negoisst*, but differed in the provided decision support. While in the first treatment group, participants were supported with economic decision support (EDS via *Negoisst*) and behavioral decision support (BDS via *vienNA*), the second treatment group was supported with EDS only. The third treatment group had only access to BDS, and the fourth treatment had neither access to economic nor behavioral decision support during the negotiation process.

In order to avoid spill-over effects, the students came from four different Universities. 36 students came from the University of Hohenheim (Germany), 105 from the University of Tilburg (The Netherlands), 43 from the University of Vienna (Austria) and 44 from the *VienNA* University of Technology (Austria).

Students received a briefing and test accounts to familiarize with the system, and a description of the example case (including general background information, private information, and the negotiation agenda). Since the experiment was conducted in a bilateral way, different information packages were provided for each negotiation party.

To ensure that the provided information was fully understood, students were asked to complete a pre-negotiation questionnaire, which also included questions about the negotiation case. As a part of the survey, information about the origin of the participants, their language skills and the familiarity with electronic negotiations and mediation was gathered.

The negotiation was conducted in an asynchronous way. The maximum duration of the negotiation process was set up to 14 days, but students were free to finish the negotiation before. Following the finish of the negotiation, students were asked to fill in a post-negotiation questionnaire.

As incentive to participate at the experiment, students received course credits at their universities, independent of the achieved outcome.

4.2 Case

The negotiation case was elaborated by the Department of Labor Science and Organization at the Institute of Management Science (Vienna University of Technology).

The case was prepared as a bilateral joint venture negotiation case. The case description was divided in i) general background information including the framework of the negotiation (which was the same for both parties) and ii) individual private information including the preferences for each party.
The negotiation problem was to set up a joint venture of two companies, namely "Mihalits AG" and "Metallurg Technologies". Therein, seven issues with a different level of conflict, but at the same time strictly opposing preferences between the parties, had to be negotiated to reach an agreement. The tables of preferences were presented to each individual party as illustrated in Figure 4.2 and Figure 4.3.

Summary of Metallurg's preferences			
Attribute	**Importance**	**Hard Constraint (Soft Constraint)**	**Aspiration Level**
Mihalits share of future revenue	20%	50% (40%)	20%
Mihalits directors in board	20%	3 members (2 members)	1 member
Secrecy clause	10%	Yes = 0.25	No = 1
Duration of contract	25%	7 years	12 years
Payment of 'common workers'	5%	Half by Metallurg Technologies, half by Mihalits AG	Mihalits AG
Additional compensation Ukrainian workers	5%	30% additional compensation	10% additional compensation
Court of jurisdiction	15%	Ukraine = 1; Austria = 0; Germany = 0.5	

Figure 4.2: Summary of Metallurg's preferences

Summary of Mihalit's preferences			
Attribute	**Importance**	**Hard Constraint (Soft Constraint)**	**Aspiration Level**
Mihalits share of future revenue	20%	50% (60%)	80%
Mihalits directors in board	20%	2 members (3 members)	4 members
Secrecy clause	25%	No = 0	Yes = 1
Duration of contract	5%	8 years	5 years
Payment of 'common workers'	5%	Half by Mihalits, half by Metallurg	Metallurg Technologies
Additional compensation Ukrainian workers	5%	10% additional compensation	20% additional compensation
Court of jurisdiction	20%	Austria = 1; Ukraine = 0; Germany = 0.7	

Figure 4.3: Summary of Mihalits' preferences

However, the private information also clarified, that there are alternatives to the current negotiation for each party on the market (BATNA), so the parties did not have settle below their hard constraints.

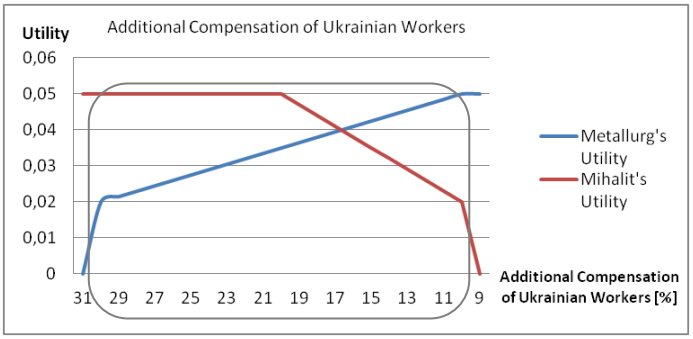
As stated above, given this private information, the case was designed in a very distributive way with a high level of conflict on the substantive level, as most issues have provided only a small zone of possible agreement (ZOPA) (see Figure 4.4).

ZOPA	
Attribut	Value
Mihalits share of future revenue	50%
Mihalits directors in board	2 -3 members
Secrecy clause	No, Yes
Duration of contract	7-8 years
Payment of 'common workers'	Half by Mihalits, half by Metallurg
Additional compensation Ukrainian workers	10% -30 % additional compensation
Court of jurisdiction	Austria, Ukraine, Germany

Figure 4.4: Zone of possible Agreement (ZOPA)

To facilitate a deeper understanding of the negotiated issues and their level of conflict in the given case, we illustrate all the given attributes and their utility values for both negotiation parties in the following (see Figure 4.5, Figure 4.6,

Figure 4.7, Figure 4.8). As we can see, both parties can each gain in total 100 per cent points over all issues, according to the individual importance of the issue. What is more, the small ZOPAs in most of the issues is revealed and depictured via a grey box.



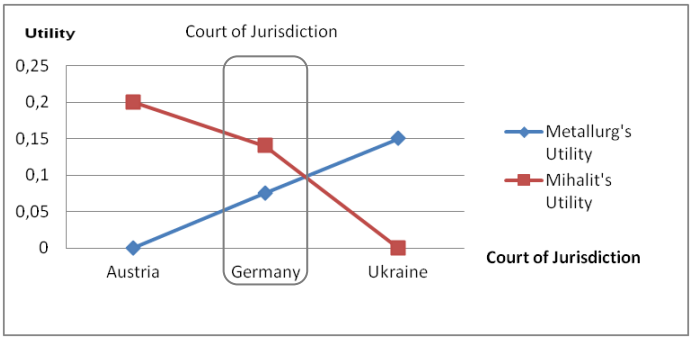


Figure 4.5: ZOPA - "Additional Compensation of Ukrainian Workers", and "Court of Jurisdiction"

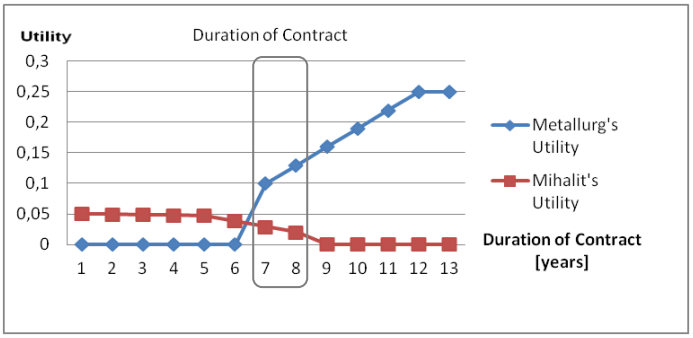


Figure 4.6: ZOPA - "Secrecy Clause", and "Duration of Contract"

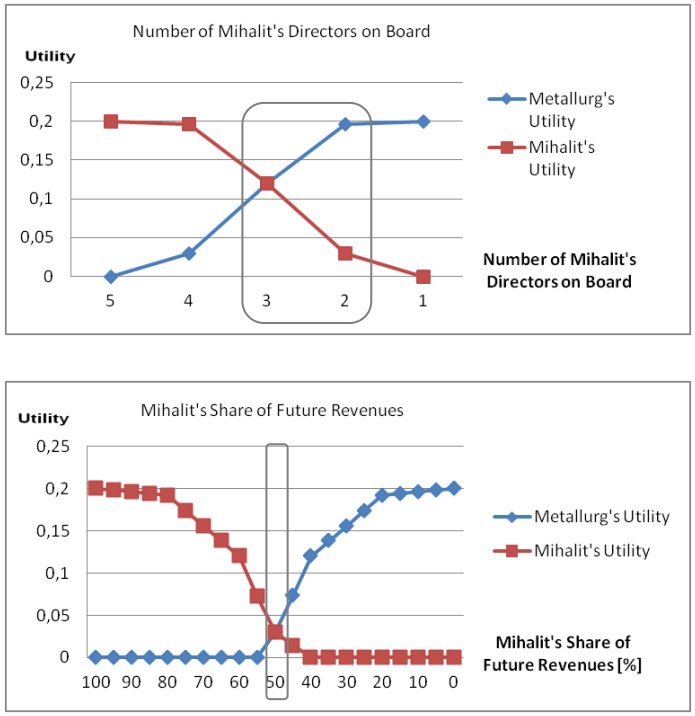


Figure 4.7: ZOPA - "Number of Mihalits' Directors on Board", and "Mihalits' Share of Future Revenues"

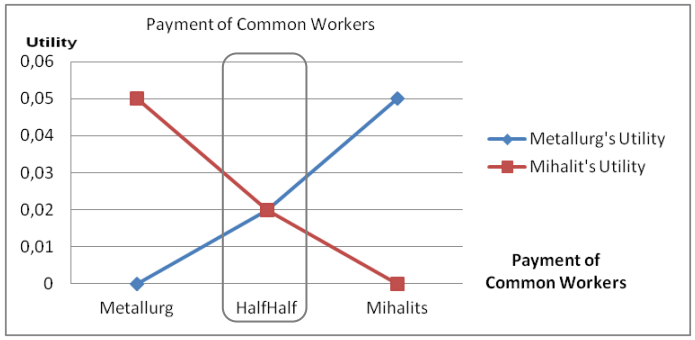


Figure 4.8: ZOPA - "Payment of Common Workers"

4.3 Systems

4.3.1 *Negoisst*

The experiment was conducted via *Negoisst*, a web-based NSS, which is currently used to support electronic negotiations in the fashion industry (Schoop 2004; Schoop 2010b; Schoop, et al. 2003).

This platform takes an holistic approach to support electronic negotiations, as it offers negotiators (i) economic decision support, (ii) communication support, and (iii) documentation support, at the same time.

(i) Decision support, in this case economic decision support, is provided through a

Multiattribute Utility Theory (MAUT) approach. Thereby, the decision support assists negotiators along the process of a negotiation.

In the preparation phase, it requires users to determine the preferences for of the negotiated issues, and prepare various alternative offer packages. However, in the present laboratory experiment preferences were predefined.

In the conduct phase, the decision support provides an instant evaluation of sent and received offers. Thereby, it aggregates the issues to overall utility values in the perspective of the focal preferences, which are then presented in numerical as well as graphical illustrations (graphical aid in form of a history graph), also depicted in Figure 4.9.

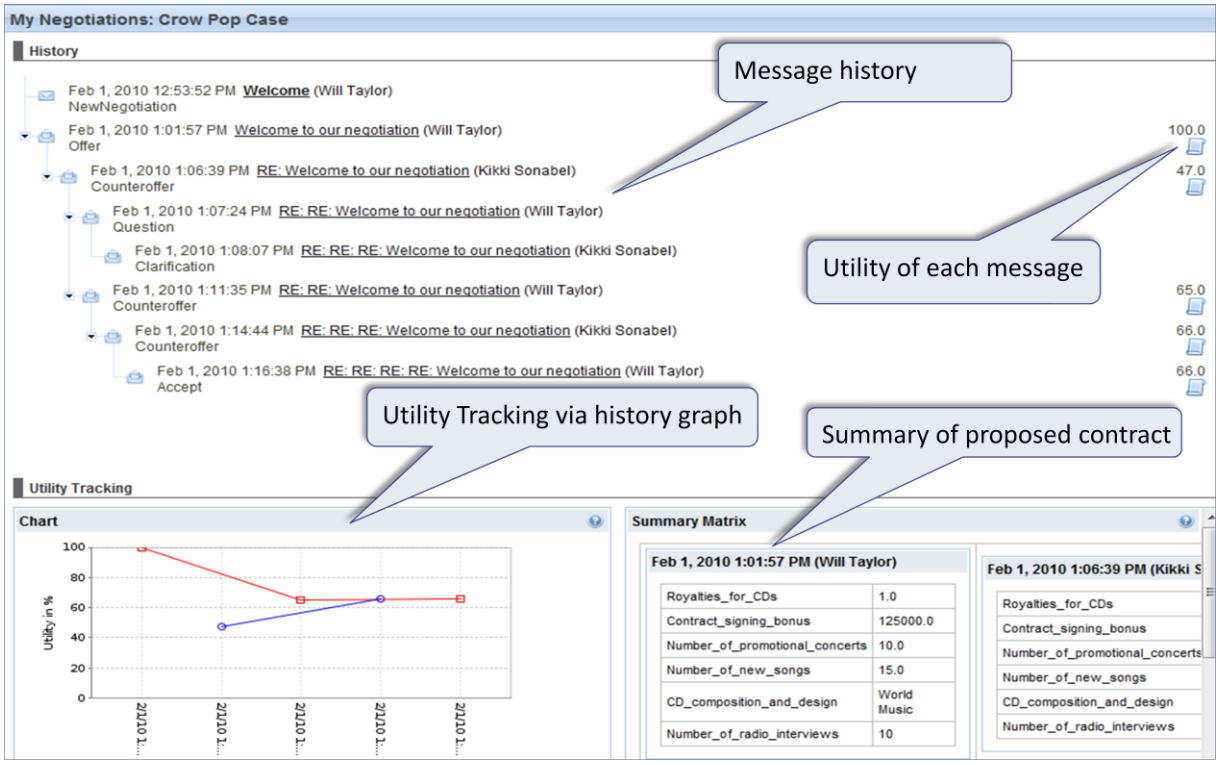


Figure 4.9: User interface in *Negoisst*, cited from (Schoop 2010a, slide 50)

(ii) Communication support is provided through the pragmatic and semantic enrichment of the exchanged messages (see Figure 4.10). Firstly, the pragmatic enrichment, aims at the specification of messages. It should enable more reasonable communication, as it allows negotiators to clarify their intention of a message, when choosing between formal (offers, counteroffers, agreements and rejection) or informal (questions and clarification) message-types. Moreover, every formal offer is legally binding and there is no way to change the message text or attribute selection after a message has been sent. Furthermore, *Negoisst* enforces a strictly alternating communication pattern, which implies that it is not

possible for negotiators to send two messages in a row.

Secondly, the semantic enrichment, intends to reduce the ambiguity of the natural language. This feature aims to avoid misunderstandings between the negotiators, as in the provided type of electronic negotiation support, nonverbal forms of communication (e.g. mimics and gestures) cannot be transmitted. This is realized, through highlighting and linking parts of the text to the negotiation agenda by choosing, in this case, predefined attributes of the negotiated issues.

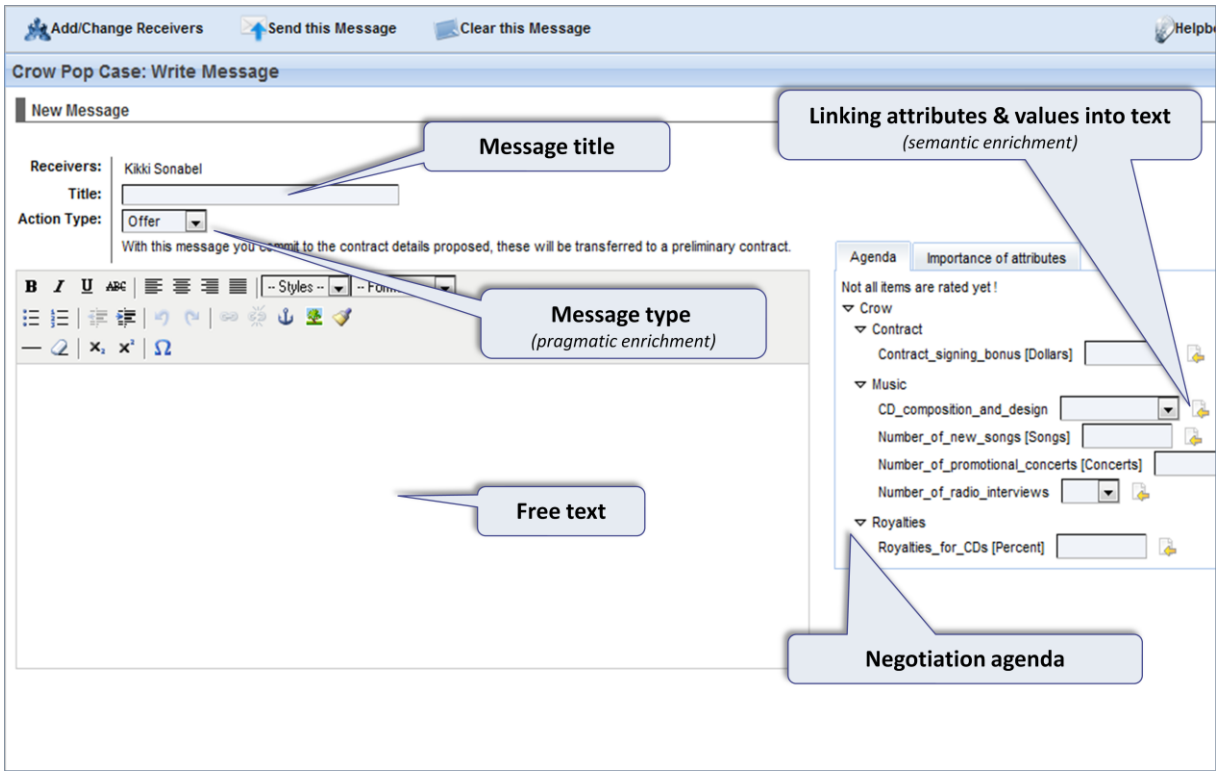


Figure 4.10: Communication support in *Negoisst*, cited from (Schoop 2010a, slide 36)

(iii) Document support is realized by storing all exchanged documents. Every sent and received message of the negotiation history can be accessed. Furthermore, "the system automatically extracts the message content, in particular the selected attributes and their values, and includes them in the current contract version" (Schoop 2004, p. 189). An illustration of the given documentation support is depicted in Figure 4.9.

Furthermore, the platform *Negoisst*, allows launching additional external negotiation support. In the underlying experiment, it was possible to launch the mediation tool *vienNA* directly on demand via link from *Negoisst*.

In summary, the economic decision support via *Negoisst* aids negotiators in the planning phase by evaluating the preferences. During the negotiation process, it facilitates the comparison of the exchanged offers and feasible alternatives, and aims at the maximization of the efficiency of the negotiation. Thereby, the presentation of utility values in the own perspective, indicates an asymmetrical decision support approach.

4.3.2 *vienNA*

The e-mediation tool Negotiator Assistant (NA) (Druckman, et al. 2004; Druckman, et al. 2002) is the predecessor for *vienNA*, the behavioral decision support (BDS), used in this laboratory experiment.

It takes an mediation approach as it intends to increase the flexibility of negotiators in aiding them advice to overcome possible impasses or stalemates.

In doing so, negotiators pass through three stages of mediation activities: i) diagnosis of the current negotiation state, ii) analysis of possible source of impasse, and iii) advice on how to resolve the impasse.

During the i) diagnosis stage, negotiators have to complete questionnaires with regard to the negotiation process and determined negotiation issues (see Figure 4.11). In this stage the negotiation progress is monitored.

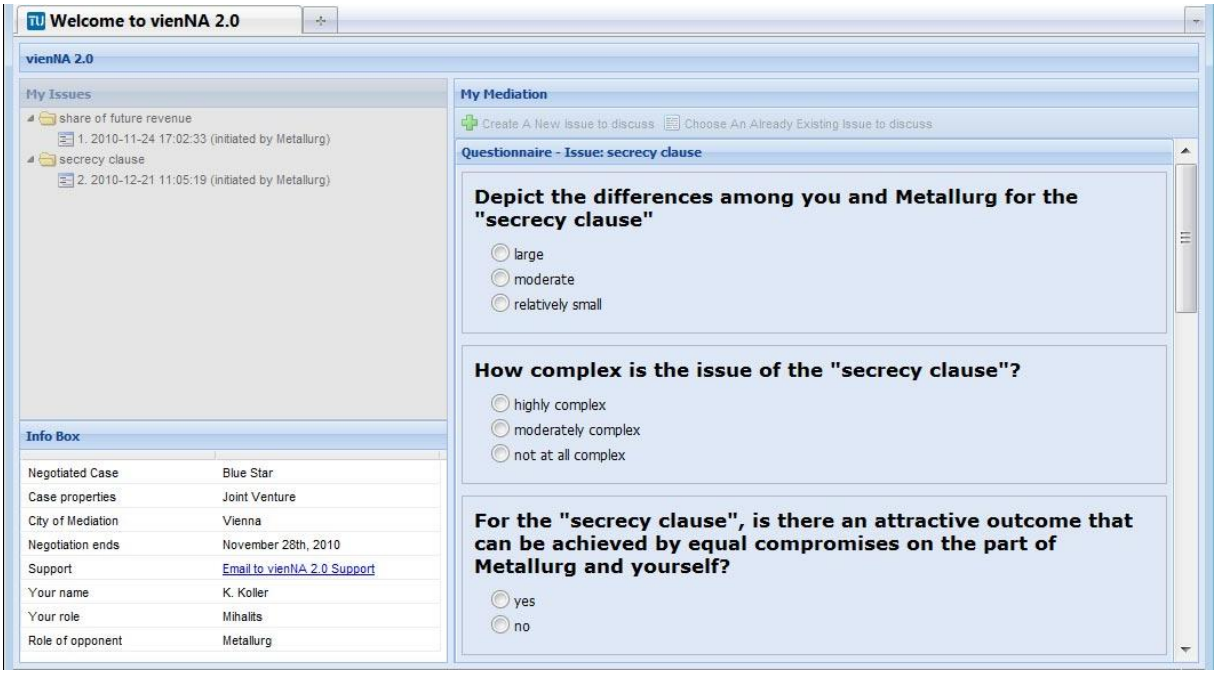


Figure 4.11: Questionnaire in *vienNA*, cited from (Koeszegi, et al. 2011, p. 3)

ii) Analysis of causes of impasse, are realized through the evaluation of the questionnaire. Thereby, weighted flexibility scores of each negotiation party are calculated and illustrated on a flexibility grid, visible to both negotiators. In this stage, possible unfavourable outcomes are identified as *vienNA* indicates: a) whether the negotiation is moving towards or away from an agreement, and b) whether this agreement is fair or unfair (see Figure 4.12).

The third and last stage iii) advice on how to overcome an impasse, is tailored to the problem that is detected. It can refer to several possible conflict resolution approaches (i.e. options/flexibility, fairness/norms, linking/logrolling, information exchange, ...) (Druckman, et al. 2004).

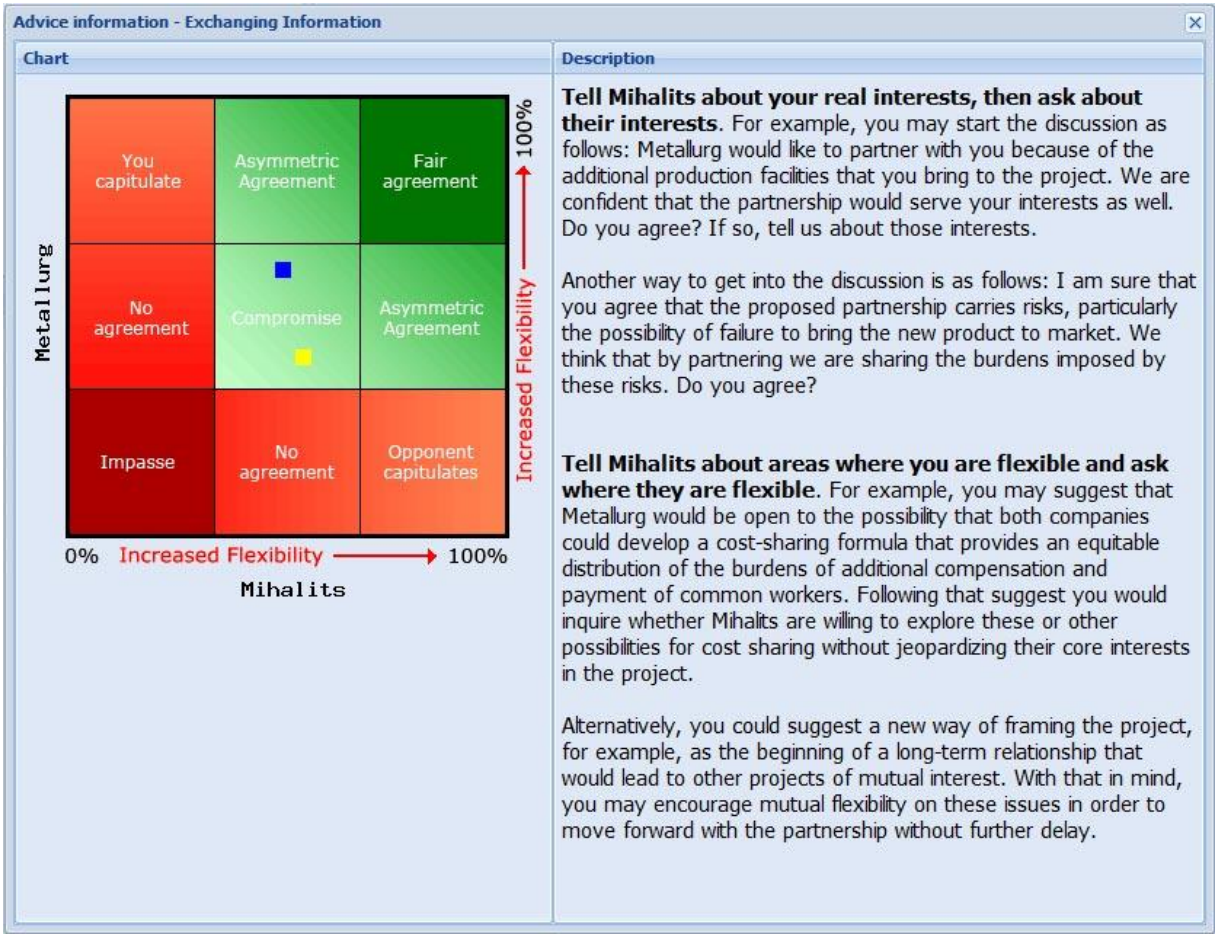


Figure 4.12: Flexibility Grid and Advice in *vienNA*, cited from (Koeszegi, et al. 2011, p. 4)

As stated above *vienNA* was directly accessible via a link at the *Negoisst* platform. Once, a negotiator has finished the questionnaires, a reminder to the opponent was sent, to finish the questionnaires as well. Once both negotiators have completed their questionnaires, one mediation round is completed. While there is no upper

boundary of mediation rounds, negotiators which had access to *vienNA*, had to conduct at least one mediation round to finish the negotiation. Therefore, users are automatically informed about the actual status of the mediation per email through a pop-up message every time they log into *Negoisst*.

As above-mentioned, the negotiation scores in the flexibility grid are visible to *both* parties. This indicates that different from the economic decision support provided in *Negoisst* (EDS conditions)- *vienNA* (BDS conditions) applies a symmetrical negotiation support approach.

In summary, *vienNA* is expected to increase negotiators flexibility by encouraging users' reflection of own needs and interests to enhance the information exchange between the negotiation parties. Thereby, it is expected to increase the prospects of reaching an agreement.

As stated above, all treatment groups were provided with communication support and documentation support (via *Negoisst*), while the analytic components (providing feedback about the exchanged offers in terms of utility values) were only available in the EDS conditions (EDS+BDS and EDS), and the behavioral support (via *vienNA*) was only available in the BDS conditions (EDS+BDS and BDS).

4.4 Method of analysis

Nowadays, managers spend more than 20 per cent of their working time in conflict resolution (Foroughi 1998; Schoop, et al. 2003). Furthermore, growing e-business and e-marketplaces will lead to an ascending use of e-negotiations (Kersten and Lai 2007). Hence several approaches of negotiation analysis have been developed. In the following part we will present an overview of the common approaches of negotiation analysis.

To present an overview of current approaches to analyze the negotiation process and outcome we follow the guide of Köszegi and Vetschera (Koeszegi and Vetschera 2010):

A negotiation can be analyzed in two dimensions: i) granularity and ii) information.

i) Granularity research can be further distinguished between the micro-, meso- and

macro level. While the micro level is concerned with single utterances of a negotiation and the meso level covers interaction patterns over several utterances along a negotiation, the macro level considers the whole negotiation process.

ii) The second dimension of negotiation analysis considers the "information" spectrum of the actual research. While an "inclusive" research covers the entire information spectrum, the "selective" method applies only to certain parts of a negotiation.

Within these two dimensions, granularity and information, we can employ seven most commonly overlapping methods of negotiation analysis (see Figure 4.13):

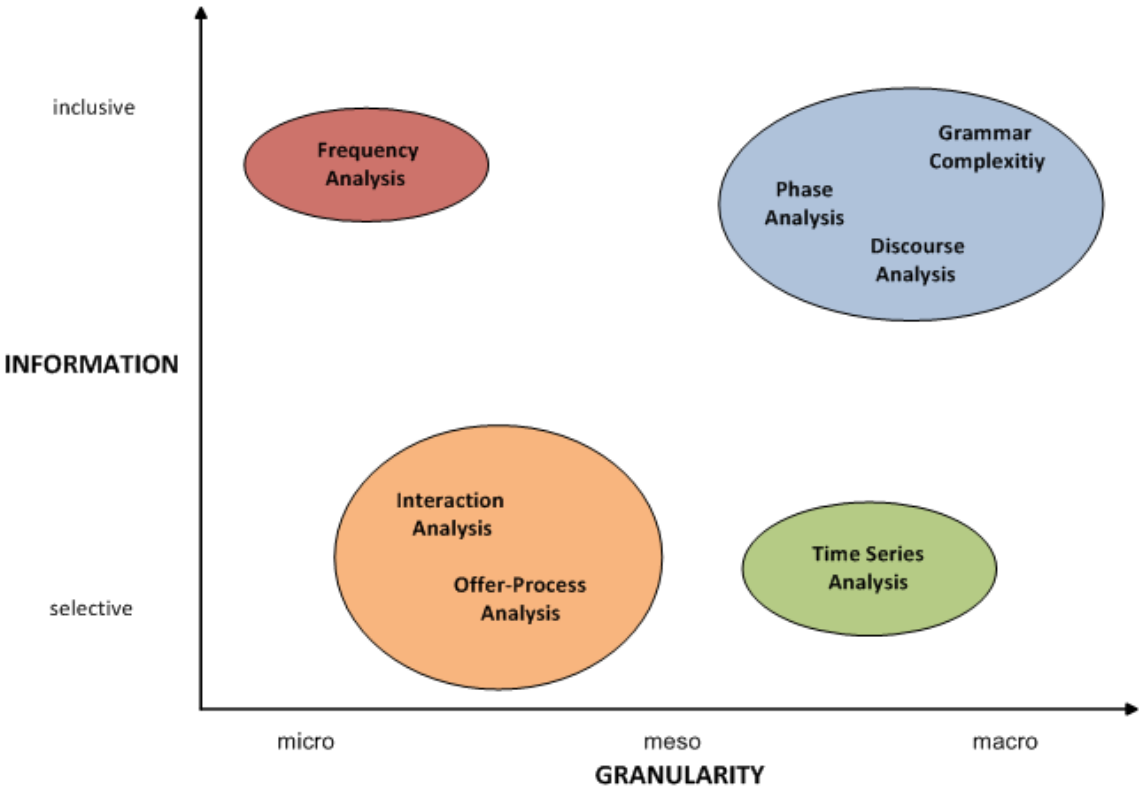


Figure 4.13: Methods of Analysis, cited from (Koeszegi and Vetschera 2010, p.124)

i)"Discourse analysis and ethnographics" is an in depth analysis, which is applied at a macro level to single cases. The research aims for a deeper understanding of a negotiation in its context, and distinguishes between conversation, pragmatics and ethnomethodology.

ii)"Frequency analysis" covers the occurrence of all communication acts of a negotiation. It is applied at a micro level as it treats individual communication

acts. Therefore, researchers have to categorize and code the qualitative data into quantitative units.

iii)"Interaction analysis" concerns the behavior of action and reaction in a negotiation dyad. However, it does not consider the point of time when this action is made.

iv)"Phase analysis" concerns the temporal structure of the entire negotiation. This method is applied at a meso-level, as it aims to understand how- and why specific behavior patterns change during a negotiation.

v)"Offer-process analysis" is based on the quantitative data of the exchanged offers. It is focused on the substantive level of a negotiation- the utility values of offers. This method can be further distinguished from the micro level (analyzing the use of every single subsequent offers), the meso level (analyzing the sequence of offer - and counteroffer of the opponent) and the macro level (analyzing aggregated frequencies over the whole negotiation duration).

vi)"Time series" methods analyze quantitative variables at discrete time points, and therefore intends to explain the relationship between variables at a certain time.

vii)"Information theory and grammar complexity" concerns the exchange of information at certain degree. It can be used to consider different types of communication units and to study their relationships.

Offer-Process Analysis

To investigate the impact of the applied support approaches on the concession behavior of negotiators, we used the offer process analysis to analyze concessions during the negotiation progress on a micro and macro level. In doing so, we employed the quantitative data of the exchanged offers which was given from the negotiation software *Negoisst*.

Example of Analysis

Firstly, we divided the given offer history from a dyad level to a single-negotiator level and excluded all informal offers. In doing so, we received an formal offer history as illustrated in Figure 4.14

Mihalits' Offers	*Additional Compensation*	*Court of jurisdiction*	*Duration of contract*	*Mihalits' members on board*	*Mihalits' share of revenue*	*Payment of common workers*	Secrecy clause	**Sender's utility**	**Receiver's utility**
1. Offer	26	Austria	5	4	85	Metallurg	Yes	0,99	0,07
2. Offer	20	Germany	8	3	85	HalfHalf	Yes	0,8	0,41
First use of vienNA									
3. Offer	20	Germany	8	3	70	HalfHalf	Yes	0,76	0,41
4. Offer	20	Germany	8	2	60	HalfHalf	Yes	0,63	0,49
5. Offer	20	Germany	7	2	50	HalfHalf	Yes	0,55	0,49

Figure 4.14: Example - Analysis of offer history

Next, we analyzed the offer history on a micro level basis, as we observed every single change of utility in every single attribute, between two subsequent offers. Thereby, we examined the impact of used bargaining steps not only on the sender or receiver of an offer separately, but also on both, sender and receiver of an offer together. Furthermore, we conducted a more specific offer process analysis. Therein, we compared the performance of users before the first use of *vienNA*- and thereafter, to analyze the impact of the behavioral decision support in more detail.

In the following Figures (Figure 4.15, Figure 4.16, Figure 4.17, Figure 4.18), we give an example of the analysis of the negotiation history illustrated in

Figure 4.14.

Mihalit's Offers	*Add. Comp.*	*Court of jurisdiction*	*Duration of contract*	*Mihalit's members on board*	*Mihalit's share of revenue*	*Payment of common workers*	*Secrecy clause*	Mihalit's utility	Metallurg's utility
1. Offer	26	Austria	5	4	85	Metallurg	yes	0,987	0,081
2. Offer	20	Germany	8	3	85	HalfHalf	yes	0,794	0,405
Mihalit's utility	0,000	-0,060	-0,027	-0,076	-	-0,030	-	-0,193	
Metallurg's utility	0,009	0,075	0,130	0,090	-	0,020	-		0,324
Joint Utility	0,009	0,015	0,103	0,014	-	-0,010	-	0,131	

Figure 4.15: Example - Analysis of offer history - first bargaining step

According to our analysis, the first bargaining step (the subsequent offer to the first offer of a negotiator, see Figure 4.15), represents a sender's utility decreasing offer, with a positive joint value. Thereby, the offer sender decreased the utility in 5 issues, whereas the offer receiver's increase of utility was in total higher than the offer sender's decrease of utility.

Mihalit's Offers	*Add. Comp.*	*Court of jurisdiction*	*Duration of contract*	*Mihalit's members on board*	*Mihalit's share of revenue*	*Payment of common workers*	*Secrecy clause*	Mihalit's utility	Metallurg's utility
2. Offer	20	Germany	8	3	85	HalfHalf	yes	0,794	0,405
	Use of vienNA								
3. Offer	20	Germany	8	3	70	HalfHalf	yes	0,756	0,405
Mihalit's utility	0,000	0,000	0,000	0,000	-0,038	0,000	0,000	-0,038	
Metallurg's utility	-	-	-	-	0,000	-	-		0,000
Joint Utility	-	-	-	-	-0,038	-	-	-0,038	

Figure 4.16: Example - Analysis of offer history - second bargaining step

The second bargaining step (see Figure 4.16) was made after the first use of *vienNA*. In our analysis, we find that Mihalits is making a unconditional concession in one issue, whereas Metallurg does not gain any utility. Thus, this bargaining step represents a sender's utility decreasing offer with a negative joint value.

Mihalit's Offers	*Add. Comp.*	*Court of jurisdiction*	*Duration of contract*	*Mihalit's members on board*	*Mihalit's share of revenue*	*Payment of common workers*	*Secrecy clause*	Mihalit's utility	Metallurg's utility
3. Offer	20	Germany	8	3	70	HalfHalf	yes	0,756	0,405
4. Offer	20	Germany	8	2	60	HalfHalf	yes	0,63	0,48
Mihalit's utility	-	-	-	-0,090	-0,036	-	-	-0,126	
Metallurg's utility	-	-	-	0,076	0,000	-	-		0,076
Joint Utility	-	-	-	-0,014	-0,036	-	-	-0,050	

Figure 4.17: Example - Analysis of offer history - third bargaining step

The third bargaining step (see Figure 4.17), represents also a sender's utility decreasing offer with a negative joint value, as the increase of Metallurg's utility is smaller than the decrease in Mihalits' utility.

Mihalit's Offers	*Add. Comp.*	*Court of jurisdiction*	*Duration of contract*	*Mihalit's members on board*	*Mihalit's share of revenue*	*Payment of common workers*	*Secrecy clause*	Mihalit's utility	Metallurg's utility
4. Offer	20	Germany	8	2	60	HalfHalf	yes	0,63	0,48
5. Offer	20	Germany	7	2	50	HalfHalf	yes	0,55	0,48
Mihalit's utility	-	-	0,009	-	-0,090	-	-	-0,081	
Metallurg's utility	-	-	-0,030	-	0,030	-	-		0,000
Joint Utility	-	-	-0,021	-	-0,060	-	-	-0,081	

Figure 4.18: Example - Analysis of offer history - fourth bargaining step

The fourth and last bargaining step of the negotiation (see Figure 4.18) represents a trade-off bargaining step as well as a sender's utility decreasing offer with a negative joint value. Thereby, the sender's utility (Mihalits' utility) is decreased by 0.081 by making a conditional concession of 0.09 (in Mihalits' share of revenue) and asking for 0.009 (in Duration of contract).

Final Sample

To analyze the impact of the applied NSSs in a consistent course, we reviewed the given the data in order to ensure that systems were used properly, and that negotiations were conducted in a reasonable way. Thus, we had to extract negotiation dyads where at least one negotiator made one or more of the following mistakes:

- Negotiators reached an agreement, although at least one hard constraint was violated.
- Negotiators in the BDS conditions (EDS+BDS and BDS) did not "really" use the behavioral decision support *vienNA*. In more detail, negotiators did just use *vienNA* in order to complete the negotiation, but the settlement of the negotiation (no matter whether it was settled as "Final Agreement" or "Final Rejection") was already made clear within the messages before.
- Negotiators used incomplete starting offers (except for testing hypotheses $H_I(1)$ "incomplete starting offers"). As we observed every single change of utility in the attributes between subsequent offers, we needed complete starting offers to analyze the impact of the applied NSSs on the frequency and quality of used bargaining steps.

After removing inappropriate negotiations, the tested sample consisted of 78 negotiators, which were allocated as depicted in Figure 4.19.

Treatments		EDS	
		yes	*no*
BDS	*yes*	**18**	**14**
	no	**38**	**8**

Figure 4.19: Negotiators' allocation to test hypotheses H_I(2-3) and H_{II-IV}

Furthermore, to test hypotheses H_V(**1-2**), concerning the performance of users before and after the first use of *vienNA*, we had to remove negotiation dyads where:

- At least one negotiator did not make at least one bargaining step (excluding the first offer of the negotiation) before- and after the first use of *vienNA*.

Thus, the tested sample to analyze hypotheses H_V(**1-2**), consisted of 20 negotiators, which were allocated as depicted in Figure 4.20.

Treatments		EDS	
		yes	*no*
BDS	*yes*	**10**	**10**

Figure 4.20: Negotiators' allocation to test hypotheses H_V

After removing inappropriate negotiation dyads, we also had to check the data, whether the intention of negotiators was then actually executed by the system. In more detail, we wanted to make sure that the number of formal or informal offers (see 4.3.1, *Negoisst*) corresponds to the number of offers the negotiator intended to send, whenever the negotiation was conducted in a reasonable way. In doing so, we ensure that the number of formal offers is not distorted by a misuse of the system by the negotiators. In the following, we show some examples, where we had to change the declaration of an offer in *Negoisst* in order to follow the clear intention of the negotiator.

- Negotiators did not use the button "Final Agreement" or "Final Reject" properly. After making clear, that the negotiation dyad did, or did not reach an agreement, users exchanged further formal messages but did not manage to end the negotiation in the recommended way. Thus, we

removed the subsequent "formal" offers, to make sure that the number of "intended" formal offers is not distorted.

- Negotiators sent a first "formal" offer by mistake, where they just wanted to introduce themselves (which should actually have been done while using an "informal" offer).
- Negotiators sent an informal offer, but made their "formal" offer intention obviously clear, within the attached message.
- Negotiators made obviously clear within the attached message that they just want to clarify their last, or request the foregone opponent's offer, but used an insistent "formal" offer wrongly instead of an informal "clarification" or "request" offer.

After this review, we tested the hypotheses according to the scheme illustrated in Figure 4.21, and the results are summarized in the following chapter.

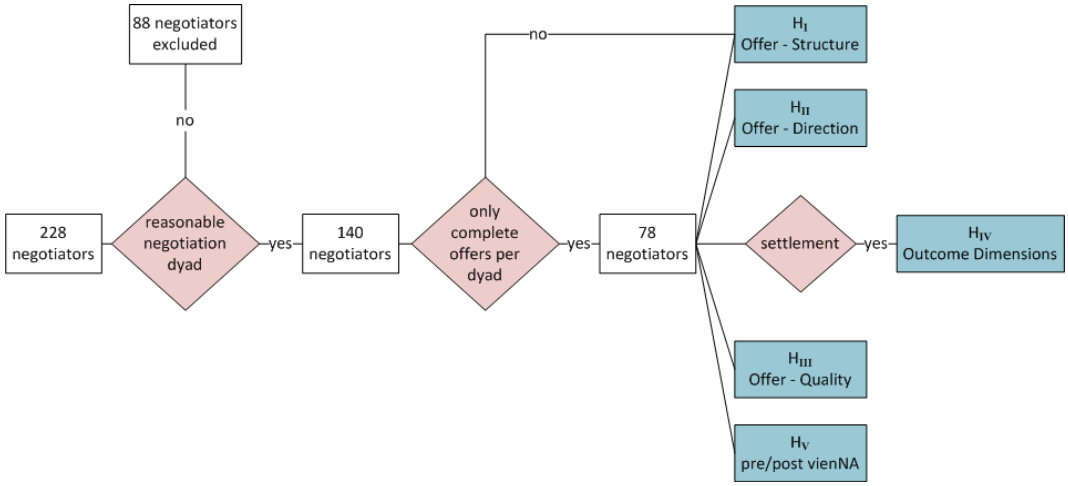


Figure 4.21: Scheme of analysis

5 Results

To examine the before presented hypotheses, we used non-parametric tests, as some of the requirements for parametric tests i) independence, ii) interval data, iii) normally distributed data, and iv) homogeneity of variance (Field 2009) were not met in all of the conducted comparisons.

Concerning the first requirement i) the independence was fulfilled as one negotiator participated in only one treatment. ii) Regarding the scale of data, all variables used (except the "complete first-offer packages" and the "agreement rate", as they represent a bivariate variable) were measured on an interval scale. We used Kolmogorov Smirnov tests to examine the iii) normality of the distribution of the data, and we conducted Levene tests to observe the iv) homogeneity of variance of the data.

Both, the normality and homogeneity of the data was violated in some issues at a significance level of $p = 0.05$. Thus, we conducted Mann-Whitney tests for the frequency analysis, and we used Fisher exact tests for the comparisons of categorical data ("complete first-offer packages" and the "agreement rate").

Concerning the comparison of the performance of users before and after the use of *vienNA,* we used Wilcoxon signed-rank tests for the pre-post comparison, and Mann-Whitney tests for the post-post comparison.

To test the expected relation between the treatments, we used one-tailed tests to test for inequality of proportions, and we used two-tailed tests to test for equality of proportions between two treatments.

The remainder of following sets within the different parts of results is organized as follows. Firstly (i) we define the tested variable and how it is calculated; and secondly (ii) we introduce the conducted tests and summarize the results.

5.1 R_I - Offer Structure

In the first part of the results we analyze the hypotheses H_I**(1-3)**, concerning the impact of the applied NSSs on the offer composition and amount of exchanged offers. We conducted Fisher exact tests to examine H_I**(1)** the use of complete first-offer packages. We then used Mann-Whitney tests to examine hypotheses H_I**(2-3)**, concerning the number of proposed contracts and the generation of alternative offer packages. Thereby, only dyads which used solely complete first-offer

packages, could be analyzed. Due to the small sample size (n=78 negotiators), or the unbalanced number within those comparisons of treatment groups, the one-tailed p-statistic was calculated as exact-test-statistic, for the comparisons of the treatments: a) BDS vs. NoDS, b) EDS vs. NoDS, d) EDS+BDS vs. NoDS, and f) EDS+BDS vs. BDS.

5.1.1 $R_I(1)$ Complete first-offer packages

i) We define a "complete first-offer package", as where "all issues of the negotiation are specified" (Filzmoser and Vetschera 2008, p. 424). Thus, an incomplete first-offer package is, when at least one issue of the negotiation is not explicitly addressed in the first offer.

ii) Hypotheses $H_I(1)$a-f, concern the influence of the applied NSSs on the use of complete first-offer packages. Since the sample size was too small to use Chi-Square tests, Fisher exact tests were conducted, and the results are summarized in Table 5.1.

Hyp.	Expectation	N		N Complete first-offer				N Incomplete first-offer				χ^2	p	H
	1 2	1	2	1	[%]	2	[%]	1	[%]	2	[%]			
$H_I(1)$a	BDS = NoDS	26	24	13	54.2%	11	45.8%	11	45.8%	13	54.2 %	0.333	0.773	✓
$H_I(1)$b	EDS > NoDS	62	24	44	71.0%	11	45.8%	18	29.0%	13	54.2 %	4.741	0.028**	✓
$H_I(1)$c	EDS > BDS	62	24	44	71.0%	13	54.2 %	18	29.0%	11	45.8%	2.185	0.111	~
$H_I(1)$d	EDS+BDS > NoDS	30	24	18	60.0%	11	45.8%	12	40.0%	13	54.2 %	1.076	0.223	~
$H_I(1)$e	EDS+BDS = EDS	30	62	18	60.0%	44	71.0 %	12	40.0%	18	29.0%	1.107	0.346	✓
$H_I(1)$f	EDS+BDS > BDS	30	24	18	60.0%	13	54.2 %	12	40.0%	11	45.8%	0.186	0.438	~

**p<0.05, ✓hypothesis confirmed, ~hypothesis not confirmed

Table 5.1: Complete first-offer packages

As predicted in hypotheses $H_I(1)$b, negotiators provided with NoDS exchange complete first-offer packages fewer often than negotiators provided with EDS (p<0.05, one-tailed).

Analyses of hypotheses $H_I(1)$a, and c- f show no significant differences in the comparison of the use of complete first-offer packages. Thus, hypotheses $H_I(1)$a and e are confirmed (p>0.10, two-tailed), and hypotheses $H_I(1)$c and f are not supported by the data (p>0.10, one-tailed).

5.1.2 $R_I(2)$ Number of proposed contracts

i) We define the "number of proposed contracts", as the amount of all "formal" proposed offers (see 4.3.1, *Negoisst*) of a negotiator during the negotiation. Thus, all "informal" offers (e.g. "questions" or "clarifications" see 4.3.1, *Negoisst*) are not included in this analysis.

ii) To test hypotheses $H_I(2)$a-f, concerning the influence of the applied NSSs on the number of proposed contracts during the negotiation, Mann-Whitney tests were conducted, and the results are summarized in Table 5.2 .

Hyp.	Expectation			Median		U	Z	r	p	H
	1		2	1	2					
$H_I(2)$a	BDS	<	NoDS	5.500	4.500	37.5	-1.289	-0.275	0.212	~
$H_I(2)$b	EDS	>	NoDS	5.000	4.500	100.0	-1.547	-0.228	0.138	~
$H_I(2)$c	EDS	>	BDS	5.000	5.500	250.5	-0.326	-0.045	0.372	~
$H_I(2)$d	EDS+BDS	=	NoDS	5.000	5.000	65.5	-0.373	-0.073	0.709	✓
$H_I(2)$e	EDS+BDS	<	EDS	5.000	5.000	248.5	-1.682	-0.225	0.046**	✓
$H_I(2)$f	EDS+BDS	>	BDS	5.000	5.500	92.0	-1.318	-0.233	0.206	~

** $p<0.05$, ✓hypothesis confirmed, ~hypothesis not confirmed

Table 5.2: Number of proposed contracts

As predicted in hypothesis $H_I(2)$e, negotiators provided with EDS+BDS exchange significantly fewer offers than those provided with EDS ($p<0.05$, one-tailed).
Analyses of hypotheses $H_I(2)$a-d, and f show no significant differences in the comparison of the number of proposed contracts during the negotiation. Thus, hypothesis $H_I(2)$d is confirmed ($p>0.10$, two-tailed), and hypotheses $H_I(1)$a-c and f are not supported by the data ($p>0.10$, one-tailed).

A visual inspection of the box plots in Figure 5.1 shows that in line with the results from the tests above, the median of EDS+BDS is similar to the median of EDS, but the upper 50% of data in EDS is much more spread. Furthermore, the box plots show a similar median and box size of EDS+BDS and NoDS.
Although we find slightly different positions of medians in the remaining comparisons of treatments, the range of scores are too high. Thus, the results of the tests above (no significant differences) in those comparisons are supported by the box plots.

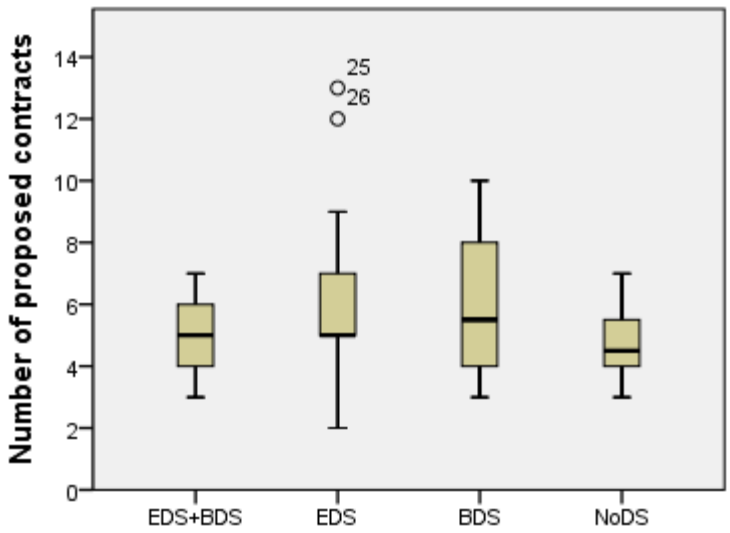


Figure 5.1: Number of proposed contracts

5.1.3 $R_I(3)$ Generation of alternative offer packages

i) We define the "generation of alternative offer packages", as the number of changed values in different issues, when employing a trade-off, a concession, or a demand bargaining step. In more detail, it is the amount of simultaneously changed values in an offer, when at least one value of an issue is exchanged, compared to the previous offer. The tested variable is then computed for each negotiator as follows.

$$\frac{number\ of\ changed\ values\ in\ different\ issues\ when\ employing\ a\ concession,\ trade-off\ or\ demand\ bargaining\ step}{number\ of\ concessions + trade-off + demand\ bargaining\ steps}$$

ii) To test hypotheses $H_I(3)$a-f, concerning the influence of the applied NSSs on the number of changed values in different issues, when employing a concession, a trade-off or a demanding bargaining step, Mann-Whitney tests were conducted, and the results are summarized in Table 5.3.

Hyp.	Expectation			Median		U	Z	r	p	H
	1		2	1	2					
H_I**(3)**a	BDS	>	NoDS	2.416	2.875	34.5	-1.471	-0.314	0.145	~
H_I**(3)**b	EDS	>	NoDS	2.875	2.875	127.5	-0.712	-0.105	0.485	~
H_I**(3)**c	EDS	>	BDS	2.875	2.416	220.0	-0.952	-0.132	0.171	~
H_I**(3)**d	EDS+BDS	>	NoDS	2.875	2.875	69.5	-0.139	-0.027	0.892	~
H_I**(3)**e	EDS+BDS	>	EDS	2.875	2.875	304.5	-0.660	-0.088	0.255	~
H_I**(3)**f	EDS+BDS	>	BDS	2.875	2.416	91.5	-1.314	-0.232	0.193	~

~hypothesis not confirmed

Table 5.3: Generation of alternative offer packages

Analyses of hypotheses H_I**(3)**a-f, show no significant differences in the comparison of the number changed values in different issues, when employing a concession, a trade-off or a demanding bargaining step. Thus, all of those hypotheses are not supported by the data (p>0.10, one-tailed).

Although we find in the visual inspection of the box plots in Figure 5.2 that the position of the medians of EDS+BDS, EDS and NoDS are equal, and the median of BDS is lower than the others, the range of scores are too high. Thus, the results of the tests above (no significant differences) are supported by the box plots.

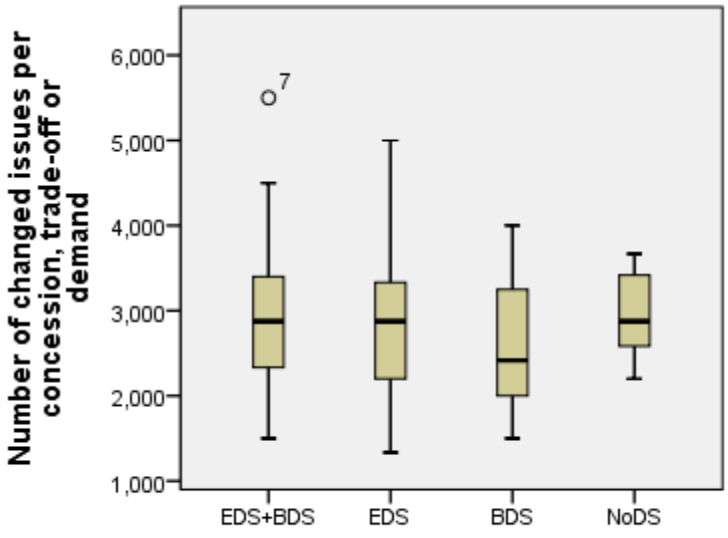


Figure 5.2: Generation of alternative offer packages

In the following we summarize the results of the first part of hypotheses (see Table 5.4).

Hyp	Dependent	Expectation			Results
H_I**(1)**a	Complete first-offer packages	BDS	=	NoDS	no significant difference
H_I**(1)**b	Complete first-offer packages	EDS	>	NoDS	p<0.05
H_I**(1)**c	Complete first-offer packages	EDS	>	BDS	no significant difference
H_I**(1)**d	Complete first-offer packages	EDS+BDS	>	NoDS	no significant difference
H_I**(1)**e	Complete first-offer packages	EDS+BDS	=	EDS	no significant difference
H_I**(1)**f	Complete first-offer packages	EDS+BDS	>	BDS	no significant difference
H_I**(2)**a	Number of proposed contracts	BDS	<	NoDS	no significant difference
H_I**(2)**b	Number of proposed contracts	EDS	>	NoDS	no significant difference
H_I**(2)**c	Number of proposed contracts	EDS	>	BDS	no significant difference
H_I**(2)**d	Number of proposed contracts	EDS+BDS	=	NoDS	no significant difference
H_I**(2)**e	Number of proposed contracts	EDS+BDS	<	EDS	p<0.05
H_I**(2)**f	Number of proposed contracts	EDS+BDS	>	BDS	no significant difference
H_I**(3)**a	Generation of alternative offer packages	BDS	>	NoDS	no significant difference
H_I**(3)**b	Generation of alternative offer packages	EDS	>	NoDS	no significant difference
H_I**(3)**c	Generation of alternative offer packages	EDS	>	BDS	no significant difference
H_I**(3)**d	Generation of alternative offer packages	EDS+BDS	>	NoDS	no significant difference
H_I**(3)**e	Generation of alternative offer packages	EDS+BDS	>	EDS	no significant difference
H_I**(3)**f	Generation of alternative offer packages	EDS+BDS	>	BDS	no significant difference

Table 5.4: Summary of results - Offer Structure

5.2 R_{II} - Offer Direction

In the second part of the results we analyze the hypotheses H_{II}**(1-4)**, concerning the impact of the applied NSSs on the offer process on the micro level. We used multiple Mann-Whitney tests and thereby, only dyads which used solely complete first-offer packages, could be analyzed. Due to the small sample size, or the unbalanced number within those comparisons of treatment groups, the one-tailed p-statistic was again calculated as exact-test-statistic, for the comparisons of the treatments: a) BDS vs. NoDS, b) EDS vs. NoDS, d) EDS+BDS vs. NoDS, and f) EDS+BDS vs. BDS.

5.2.1 R_{II}(1) Frequency of concessions and trade-offs

i) We calculate the "frequency of concessions and trade-offs", as ratio of the number of used concessions and trade-offs, and the total number of used bargaining steps (the number of proposed contracts excluding the first offer). The tested variable is then computed for each negotiator as follows.

$$\frac{number\ of\ concession + trade - off\ bargaining\ steps}{number\ of\ concession + trade - off + insistence + demand\ bargaining\ steps}$$

ii) To test hypotheses H_{II}**(1)**a-f, concerning the influence of the applied NSSs on the frequency of concessions and trade-offs, Mann-Whitney tests were conducted, and the results are summarized in Table 5.5.

Hyp.	Expectation			Median		U	Z	r	p	H
	1		2	1	2					
H_{II}**(1)**a	BDS	>	NoDS	1.000	1.000	48.0	-0.744	-0.159	0.616	~
H_{II}**(1)**b	EDS	>	NoDS	1.000	1.000	121.0	-1.104	-0.163	0.384	~
H_{II}**(1)**c	EDS	>	BDS	1.000	1.000	241.5	-0.607	-0.084	0.272	~
H_{II}**(1)**d	EDS+BDS	>	NoDS	1.000	1.000	54.5	-1.191	-0.234	0.338	~
H_{II}**(1)**e	EDS+BDS	>	EDS	1.000	1.000	324.5	-0.359	-0.048	0.360	~
H_{II}**(1)**f	EDS+BDS	>	BDS	1.000	1.000	108.5	-0.785	-0.139	0.512	~

~hypothesis not confirmed

Table 5.5: Frequency of concessions and trade-offs

Analyses of hypotheses H_{II}**(1)**a-f, show no significant differences in the frequency of concessions and trade-offs. Thus, all of those hypotheses are not supported by the data ($p>0.10$, one-tailed).

A visual inspection of the box plots in Figure 5.3 shows similar positions of medians in all treatments, and a high range of score in all treatments- excluding the NoDS group. Thus, the results of the tests above (no significant differences) are supported by the box plots.

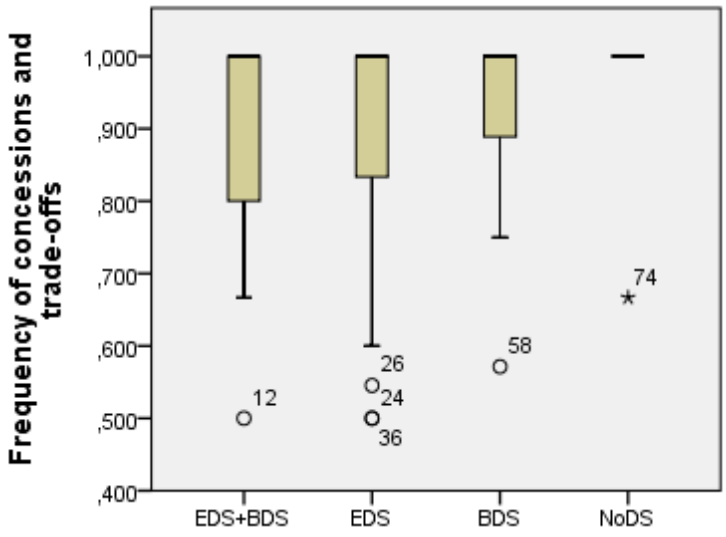


Figure 5.3: Frequency of concessions and trade-offs

5.2.2 R_{II}(2a) Frequency of sender's utility decreasing offers

i) We calculate the "frequency of sender's utility decreasing offers", as ratio of the number of offers where the sender's utility is decreased, and the total number of used bargaining steps. The tested variable is then computed for each negotiator as follows.

$$\frac{number\ of\ sender's\ utility\ decreasing\ offers}{number\ of\ used\ bargaining\ steps}$$

ii) To test hypotheses H_{II}**(2a)**a-f, concerning the influence of the applied NSSs on the frequency of offers where the offer sender's utility is decreased, Mann-Whitney tests were conducted, and the results are summarized in Table 5.6.

Hyp.	Expectation		Median		U	Z	r	p	H
	1	2	1	2					
H_{II}**(2a)**a	BDS > NoDS		1.000	1.000	44.0	-1.044	-0.223	0.441	~
H_{II}**(2a)**b	EDS > NoDS		0.854	1.000	95.0	-1.807	-0.266	0.102	~
H_{II}**(2a)**c	EDS < BDS		0.854	1.000	212.0	-1.204	-0.167	0.114	~
H_{II}**(2a)**d	EDS+BDS > NoDS		0.900	1.000	47.5	-1.559	-0.306	0.177	~
H_{II}**(2a)**e	EDS+BDS > EDS		0.900	0.854	336.5	-0.103	-0.014	0.459	~
H_{II}**(2a)**f	EDS+BDS > BDS		0.900	1.000	105.5	-0.860	-0.152	0.442	~

~hypothesis not confirmed

Table 5.6: Frequency of sender's utility decreasing offers

Analyses of hypotheses H_{II}**(2a)**a-f, show no significant differences in the frequency of frequency of offers, where the offer sender's utility is decreased. Thus, all of those hypotheses are not supported by the data ($p>0.10$, one-tailed).

Although we find different positions of medians in the visual inspection of the box plots (see Figure 5.4), the range of scores in the treatments EDS+BDS, EDS and BDS are again too high. Thus, the results of the tests above (no significant differences) are supported by the box plots.

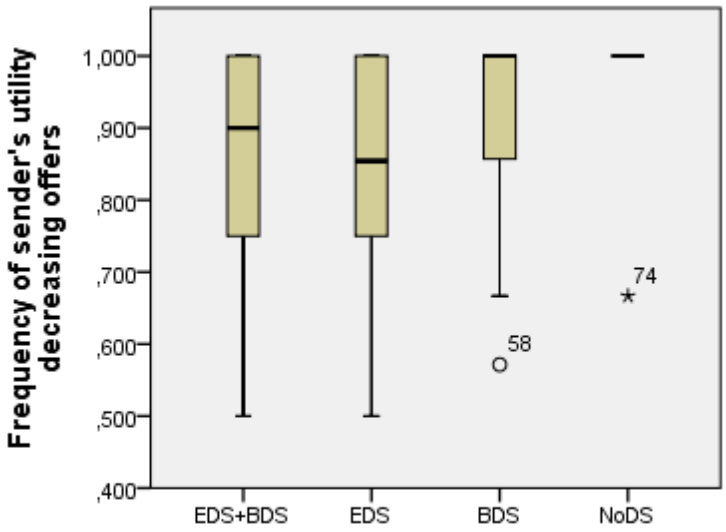


Figure 5.4: Frequency of sender's utility decreasing offers

5.2.3 R_{II}(2b) Frequency of receiver's utility increasing offers

i) We calculate the "frequency of receiver's utility increasing offers", as ratio of the number of offers where the receiver's utility is increased, and the total number of used bargaining steps. The tested variable is then computed for each negotiator as follows.

$$\frac{number\ of\ receiver's\ utility\ increasing\ offers}{number\ of\ used\ bargaining\ steps}$$

ii) To test hypotheses H_{II}**(2b)**a-f, concerning the influence of the applied NSSs on the frequency of offers, where the offer receiver's utility is increased, Mann-Whitney tests were conducted, and the results are summarized in Table 5.7.

Hyp.	Expectation		Median		U	Z	r	p	H
	1	2	1	2					
H_{II}**(2b)**a	BDS >	NoDS	0.770	0.875	47.0	-0.648	-0.138	0.570	~
H_{II}**(2b)**b	EDS =	NoDS	0.750	0.875	122.0	-0.892	-0.131	0.373	✓
H_{II}**(2b)**c	EDS <	BDS	0.750	0.770	252.5	-0.285	-0.040	0.388	~
H_{II}**(2b)**d	EDS+BDS >	NoDS	0.800	0.875	64.0	-0.461	-0.090	0.683	~
H_{II}**(2b)**e	EDS+BDS >	EDS	0.800	0.750	310.0	-0.573	-0.077	0.283	~
H_{II}**(2b)**f	EDS+BDS =	BDS	0.800	0.770	123.0	-0.118	-0.021	0.906	✓

✓hypothesis confirmed, ~hypothesis not confirmed

Table 5.7: Frequency of receiver's utility increasing offers

Analyses of hypotheses H_{II}**(2b)**a-f show no significant differences in the comparison of the frequency of offers, where the offer receiver's utility is increased. Thus, hypotheses H_{II}**(2b)**b and f are confirmed (p>0.10, two-tailed), and hypotheses H_{II}**(2b)**a, and c-e are not supported by the data (p>0.10, one-tailed).

Although we find different positions of medians in the visual inspection of the box plots (see Figure 5.5), the range of scores in all treatments are too high. Thus, the results of the tests above (no significant differences) are supported by the box plots.

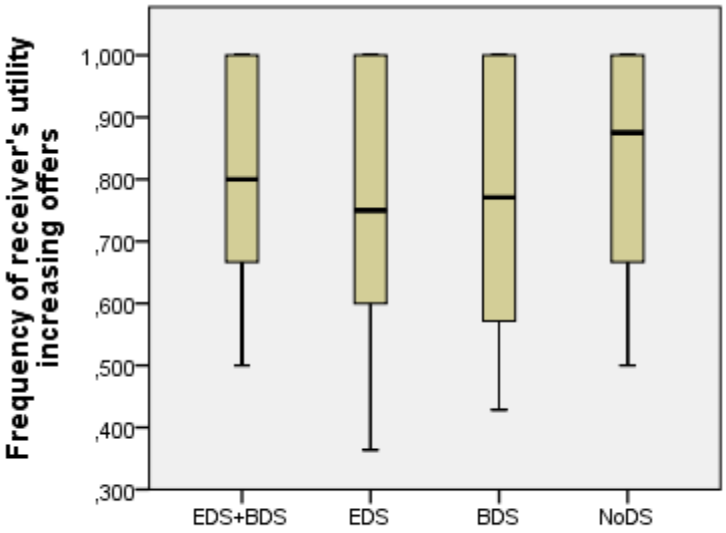


Figure 5.5: Frequency of receiver's utility increasing offers

5.2.4 R_{II}(3a) Average size of sender's utility decreasing offers

i) We calculate the "average size of sender's utility decreasing offers", as ratio of the accumulated size of sender's utility decreasing offers (i.e. we sum up all the reductions of utility of two subsequent offers, when the overall utility is lower than in the foregone offer), and the number of sender's utility decreasing offers. The tested variable is then computed for each negotiator as follows.

$$\frac{accumulated\ size\ of\ sender's\ decreased\ utility}{number\ of\ sender's\ utility\ decreasing\ offers}$$

ii) To test hypotheses H_{II}**(3a)**a-f, concerning the influence of the applied NSSs on the average size of sender's utility decreasing offers, Mann-Whitney tests were conducted, and the results are summarized in Table 5.8.

Hyp.	Expectation			Median		U	Z	r	p	H
	1		2	1	2					
H_{II}**(3a)**a	BDS	>	NoDS	0.090	0.133	35.0	-1.433	-0.306	0.165	~
H_{II}**(3a)**b	EDS	<	NoDS	0.100	0.133	99.5	-1.522	-0.224	0.130	~
H_{II}**(3a)**c	EDS	<	BDS	0.100	0.090	227.0	-0.805	-0.112	0.211	~
H_{II}**(3a)**d	EDS+BDS	=	NoDS	0.110	0.133	59.0	-0.722	-0.142	0.470	✓
H_{II}**(3a)**e	EDS+BDS	>	EDS	0.110	0.100	283.5	-1.026	-0.137	0.152	~
H_{II}**(3a)**f	EDS+BDS	<	BDS	0.110	0.090	89.5	-1.387	-0.245	0.168	~

✓hypothesis confirmed, ~hypothesis not confirmed

Table 5.8: Average size of sender's utility decreasing offers

Analyses of hypotheses H_{II}**(3a)**a-f show no significant differences in the comparison of the average size of offers, where the offer sender's utility is decreased. Thus, hypothesis H_{II}**(3)**d is confirmed (p>0.10, two-tailed), and hypotheses H_{II}**(3a)**a-c, e and f are not supported by the data (p>0.10, one-tailed).

Although we find different positions of medians in the visual inspection of the box plots (see Figure 5.6), the range of scores in all treatments are too high. Thus, the results of the tests above (no significant differences) are supported by the box plots.

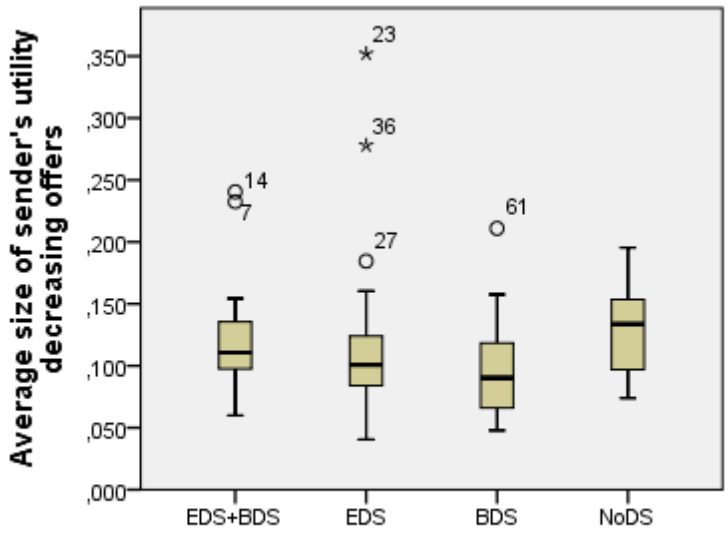


Figure 5.6: Average size of sender's utility decreasing offers

5.2.5 R_{II}(3b) Average size of receiver's-utility-increasing offers

i) We calculate the "average size of receiver's utility increasing offers", as ratio of the accumulated size of the offer receiver's increased utility, and the

number of receiver's utility increasing offers. The tested variable is then computed for each negotiator as follows.

$$\frac{accumulated\ size\ of\ receiver's\ increased\ utility}{number\ of\ receiver's\ utility\ increased\ offers}$$

ii) To test hypotheses H_{II}**(3b)**a-f, concerning the influence of the applied NSSs on the average size of receiver's utility increasing offers, Mann-Whitney tests were conducted, and the results are summarized in Table 5.9.

Hyp.	Expectation			Median		U	Z	r	p	H
	1		2	1	2					
H_{II}**(3b)**a	BDS	>	NoDS	0.110	0.173	35.0	-1.433	-0.306	0.165	~
H_{II}**(3b)**b	EDS	<	NoDS	0.126	0.173	100.0	-1.507	-0.222	0.138	~
H_{II}**(3b)**c	EDS	<	BDS	0.126	0.110	219.5	-0.959	-0.133	0.169	~
H_{II}**(3b)**d	EDS+BDS	=	NoDS	0.146	0.173	54.5	-0.972	-0.191	0.331	✓
H_{II}**(3b)**e	EDS+BDS	>	EDS	0.146	0.126	292.5	-0.868	-0.116	0.193	~
H_{II}**(3b)**f	EDS+BDS	<	BDS	0.146	0.110	96.5	-1.121	-0.198	0.267	~

✓hypothesis confirmed, ~hypothesis not confirmed

Table 5.9: Average size of receiver's utility increasing offers

Analyses of hypotheses H_{II}**(3b)**a-f show no significant differences in the comparison of the average size of offers, where the offer receiver's utility is increased. Thus, hypothesis H_{II}**(3b)**d is confirmed ($p>0.10$, two-tailed), and hypotheses H_{II}**(3b)**a-c, e and f are not supported by the data ($p>0.10$, one-tailed).

Although we find different positions of medians in the visual inspection of the box plots (see Figure 5.7), the range of scores in all treatments are too high. Thus, the results of the tests above (no significant differences) are supported by the box plots.

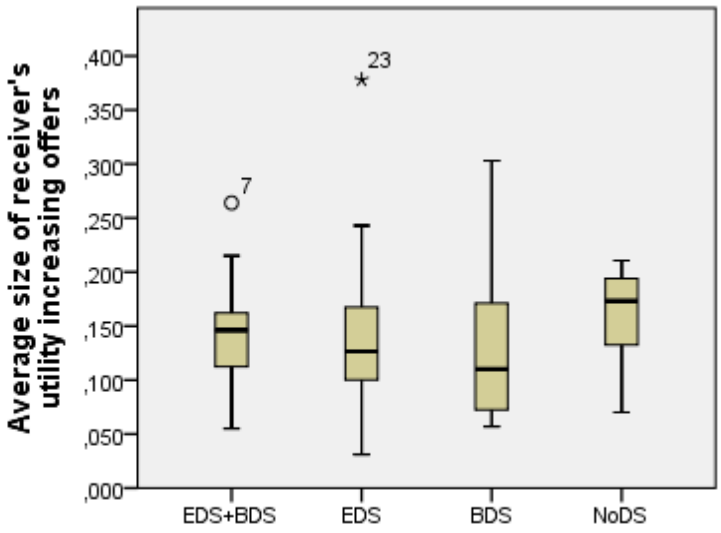


Figure 5.7: Average size of receiver's utility increasing offers

5.2.6 $R_{II}(4)$ Ratio of unconditional and total concession size

i) We calculate the relation between "unconditional and total concession size", as ratio of the accumulated size of utility decreased in concession bargaining steps, and the total sum of decreased utility made in trade-off and concession bargaining steps. The tested variable is then computed for each negotiator as follows.

$$\frac{accumulated\ size\ of\ utility\ decreased\ in\ concession\ bargaining\ steps}{accumulated\ size\ of\ utility\ decreased\ in\ concession\ +\ trade-off\ bargaining\ steps}$$

ii) To test hypotheses H_{II}**(3b)**a-f, concerning the influence of the applied NSSs on the use unconditional and conditional concessions, Mann-Whitney tests were conducted, and the results are summarized in Table 5.10.

Hyp.	Expectation			Median		U	Z	r	p	H
	1		2	1	2					
H_{II}**(4)**a	BDS	<	NoDS	0.765	0.961	45.0	-0.778	-0.166	0.482	~
H_{II}**(4)**b	EDS	>	NoDS	0.766	0.961	121.5	-0.907	-0.134	0.384	~
H_{II}**(4)**c	EDS	>	BDS	0.766	0.765	261.5	-0.095	-0.013	0.462	~
H_{II}**(4)**d	EDS+BDS	=	NoDS	0.878	0.961	70.0	-0.117	-0.023	0.907	✓
H_{II}**(4)**e	EDS+BDS	<	EDS	0.878	0.766	257.5	-1.523	-0.204	0.064*	X
H_{II}**(4)**f	EDS+BDS	>	BDS	0.878	0.765	90.0	-1.416	-0.250	0.180	~

*p<0.10, ✓hypothesis confirmed, ~hypothesis not confirmed, xcontrary to prediction

Table 5.10: Ratio of unconditional and total concession size

Contrary to the prediction in H_{II}**(4)**e, negotiators provided with EDS+BDS made in relation more unconditional than conditional concessions than those provided with EDS ($p<0.10$, one-tailed).

Analyses of hypotheses H_{II}**(4)**a-d and f show no significant differences in the relation of the unconditional and total concession size. Thus, hypothesis H_{II}**(4)**d is confirmed ($p>0.10$, two-tailed), and hypotheses H_{II}**(4)**a- c, e and f are not supported by the data ($p>0.10$, one-tailed).

A visual inspection of the box plots in Figure 5.8 shows that in line with the results from the tests above, the median of EDS+BDS is higher than the median of EDS. Furthermore, the lower 50% of data in EDS is much more spread than in EDS+BDS. What is more, the box plots show similar medians of EDS+BDS and NoDS, and EDS and BDS. As the range of scores in the treatments EDS and BDS is very high, the results of the tests above (no significant differences) in the remaining comparisons are supported by the box plots.

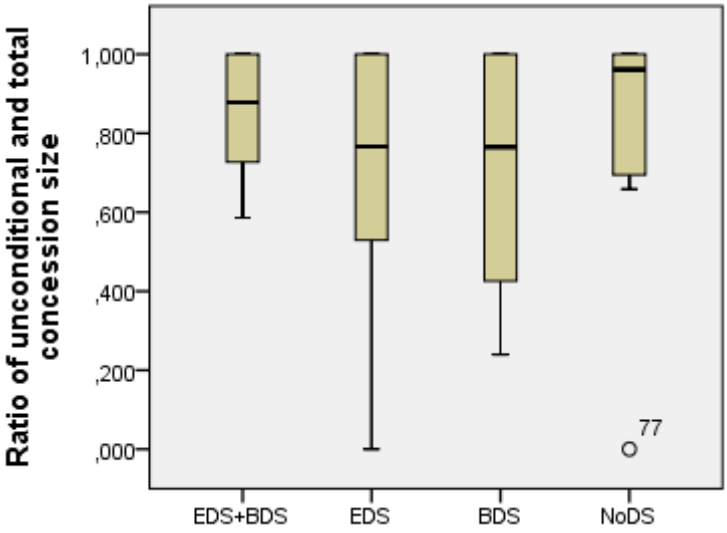


Figure 5.8: Ratio of unconditional and total concession size

In addition, we found further interesting results, when we analyzed the ratio of unconditional and total concession size in the most conflicting issue (share of revenue). Therein, we found partial support for hypothesis H_{II}**(4)**a, where the results show that the ratio of unconditional and total concession size of users with BDS is significantly lower than those of users with NoDS ($p= 0.056$, one-tailed). However, in contrast to our prediction in hypotheses H_{II}**(4)**b and e, the results showed, that the ratio of unconditional and total concession size in the most conflicting issue of users with EDS is significantly lower than those of users with NoDS ($p= 0.072$, one-tailed), and those of users with EDS+BDS ($p= 0.055$, one-tailed), respectively.

In the following we summarize the results of the second part of hypotheses (see Table 5.11).

Hyp	Dependent	Expectation			Results
H_{II}**(1)**a	Frequency of concessions and trade-offs	BDS	>	NoDS	no significant difference
H_{II}**(1)**b	Frequency of concessions and trade-offs	EDS	>	NoDS	no significant difference
H_{II}**(1)**c	Frequency of concessions and trade-offs	EDS	>	BDS	no significant difference
H_{II}**(1)**d	Frequency of concessions and trade-offs	EDS+BDS	>	NoDS	no significant difference
H_{II}**(1)**e	Frequency of concessions and trade-offs	EDS+BDS	>	EDS	no significant difference
H_{II}**(1)**f	Frequency of concessions and trade-offs	EDS+BDS	>	BDS	no significant difference
H_{II}**(2a)**a	Frequency of sender's utility decreasing offers	BDS	>	NoDS	no significant difference
H_{II}**(2a)**b	Frequency of sender's utility decreasing offers	EDS	>	NoDS	no significant difference
H_{II}**(2a)**c	Frequency of sender's utility decreasing offers	EDS	<	BDS	no significant difference
H_{II}**(2a)**d	Frequency of sender's utility decreasing offers	EDS+BDS	>	NoDS	no significant difference
H_{II}**(2a)**e	Frequency of sender's utility decreasing offers	EDS+BDS	>	EDS	no significant difference
H_{II}**(2a)**f	Frequency of sender's utility decreasing offers	EDS+BDS	>	BDS	no significant difference
H_{II}**(2b)**a	Frequency of receiver's utility increasing offers	BDS	>	NoDS	no significant difference
H_{II}**(2b)**b	Frequency of receiver's utility increasing offers	EDS	=	NoDS	no significant difference
H_{II}**(2b)**c	Frequency of receiver's utility increasing offers	EDS	<	BDS	no significant difference
H_{II}**(2b)**d	Frequency of receiver's utility increasing offers	EDS+BDS	>	NoDS	no significant difference
H_{II}**(2b)**e	Frequency of receiver's utility increasing offers	EDS+BDS	>	EDS	no significant difference
H_{II}**(2b)**f	Frequency of receiver's utility increasing offers	EDS+BDS	=	BDS	no significant difference
H_{II}**(3a)**a	Average size of sender's utility decreasing offers	BDS	>	NoDS	no significant difference
H_{II}**(3a)**b	Average size of sender's utility decreasing offers	EDS	<	NoDS	no significant difference
H_{II}**(3a)**c	Average size of sender's utility decreasing offers	EDS	<	BDS	no significant difference
H_{II}**(3a)**d	Average size of sender's utility decreasing offers	EDS+BDS	=	NoDS	no significant difference
H_{II}**(3a)**e	Average size of sender's utility decreasing offers	EDS+BDS	>	EDS	no significant difference
H_{II}**(3a)**f	Average size of sender's utility decreasing offers	EDS+BDS	<	BDS	no significant difference
H_{II}**(3b)**a	Average size of receiver's utility increasing offers	BDS	>	NoDS	no significant difference
H_{II}**(3b)**b	Average size of receiver's utility increasing offers	EDS	<	NoDS	no significant difference
H_{II}**(3b)**c	Average size of receiver's utility increasing offers	EDS	<	BDS	no significant difference
H_{II}**(3b)**d	Average size of receiver's utility increasing offers	EDS+BDS	=	NoDS	no significant difference
H_{II}**(3b)**e	Average size of receiver's utility increasing offers	EDS+BDS	>	EDS	no significant difference
H_{II}**(3b)**f	Average size of receiver's utility increasing offers	EDS+BDS	<	BDS	no significant difference
H_{II}**(4)**a	Ratio of unconditional and total concession size	BDS	<	NoDS	no significant difference
H_{II}**(4)**b	Ratio of unconditional and total concession size	EDS	>	NoDS	no significant difference
H_{II}**(4)**c	Ratio of unconditional and total concession size	EDS	>	BDS	no significant difference
H_{II}**(4)**d	Ratio of unconditional and total concession size	EDS+BDS	=	NoDS	no significant difference
H_{II}**(4)**e	Ratio of unconditional and total concession size	EDS+BDS	<	EDS	$p<0.10$ contrary to prediction
H_{II}**(4)**f	Ratio of unconditional and total concession size	EDS+BDS	>	BDS	no significant difference

Table 5.11: Summary of results - Offer Direction

5.3 R_{III} - Offer Quality

In the third part of the results we analyze the hypotheses H_{III}**(1)**, concerning the impact of the applied NSSs on the quality of the made concessions. We used multiple Mann-Whitney tests and thereby, only dyads which used solely complete first-offer packages, could be analyzed. Due to the small sample size, or the unbalanced number within those comparisons of treatment groups, the one-tailed p-statistic was again calculated as exact-test-statistic, for the comparisons of the treatments: a) BDS vs. NoDS, b) EDS vs. NoDS, d) EDS+BDS vs. NoDS, and f) EDS+BDS vs. BDS.

5.3.1 R_{III}(1) Frequency of sender's utility decreasing offers with a positive joint value

i) We calculate the "frequency of sender's utility decreasing offers with a positive joint value", as ratio of the number of sender's utility decreasing offers with a positive joint value, and the total number of used bargaining steps. The tested variable is then computed for each negotiator as follows.

$$\frac{number\ of\ sender's\ utility\ decreasing\ offers\ with\ a\ positive\ joint\ value}{number\ of\ used\ bargaining\ steps}$$

ii) To test hypotheses H_{III}**(1)**a-f, concerning the influence of the applied NSSs on the frequency of offers, where the joint value of a sender's utility decreasing offer for sender and receiver is greater than 0, Mann-Whitney tests were conducted, and the results are summarized in Table 5.12.

Hyp.	Expectation	Median		U	Z	r	p	H
	1 > 2	1	2					
H_{III}**(1)**a	BDS > NoDS	0.250	0.250	45.0	-0.757	-0.161	0.482	~
H_{III}**(1)**b	EDS > NoDS	0.250	0.250	146.5	-0.162	-0.024	0.876	~
H_{III}**(1)**c	EDS > BDS	0.250	0.250	225.5	-0.844	-0.117	0.199	~
H_{III}**(1)**d	EDS+BDS > NoDS	0.333	0.250	38.0	-1.917	-0.376	0.062*	✓
H_{III}**(1)**e	EDS+BDS > EDS	0.333	0.250	223.5	-2.100	-0.281	0.018**	✓
H_{III}**(1)**f	EDS+BDS > BDS	0.333	0.250	100.5	-0.975	-0.172	0.338	~

*p<0.10, **p<0.05, ✓hypothesis confirmed, ~hypothesis not confirmed

Table 5.12: Frequency of sender's utility decreasing offers with a positive joint value

As predicted in hypothesis H_{III}**(1)** e, the frequency of sender's utility decreasing offers, where the joint value for sender and receiver is greater than 0, of users with EDS+BDS is higher than those of users with EDS ($p<0.05$, one-tailed). Concerning hypothesis H_{III}**(1)**d, there is a tendency that users with EDS+BDS use a higher frequency of sender's utility decreasing offers with a positive joint value than users with NoDS ($p<0.10$, one-tailed).

Analyses of hypotheses H_{III}**(1a)**a-c and f show no significant differences in the frequency of sender's utility decreasing offers, where the joint value for sender and receiver is greater than 0. Thus, all of those hypotheses are not supported by the data ($p>0.10$, one-tailed).

A visual inspection of the box plots in Figure 5.9 shows that in line with the results from the tests above, the median of EDS+BDS is higher than the median of EDS and higher than the median of NoDS. As the range of scores in the treatments EDS and BDS is very high, the results of the tests above (no significant differences) in the remaining comparisons are supported by the box plots.

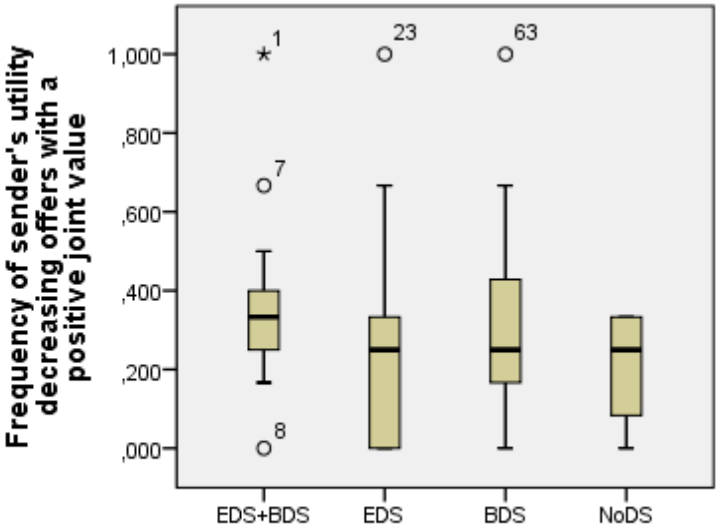


Figure 5.9: Frequency of sender's utility decreasing steps with a positive joint value

In addition, we found further interesting results, when we analyzed the average *size* of the sender's utility decreasing steps with a positive joint value. The results show that the size of this positive joint value of users with NoDS is significantly higher than those of users with EDS+BDS ($p= 0.044$, one-tailed). Furthermore, there is tendency that the average size of sender's utility decreasing steps with a positive joint value of users with NoDS is higher than those of users with BDS ($p= 0.083$, one-tailed).

In the following we summarize the results of the third part of hypotheses (see Table 5.13).

Hyp	Dependent	Expectation			Results
H_{III}**(1)**a	Frequency of positive sender's utility decreasing offers	BDS	>	NoDS	no significant difference
H_{III}**(1)**b	Frequency of positive sender's utility decreasing offers	EDS	>	NoDS	no significant difference
H_{III}**(1)**c	Frequency of positive sender's utility decreasing offers	EDS	>	BDS	no significant difference
H_{III}**(1)**d	Frequency of positive sender's utility decreasing offers	EDS+BDS	>	NoDS	$p<0.10$
H_{III}**(1)**e	Frequency of positive sender's utility decreasing offers	EDS+BDS	>	EDS	$p<0.05$
H_{III}**(1)**f	Frequency of positive sender's utility decreasing offers	EDS+BDS	>	BDS	no significant difference

Table 5.13: Summary of results - Offer Quality

5.4 R_{IV} - Outcome Analysis

In the fourth part of the results we analyze the hypotheses H_{IV}**(1-3)**, concerning the impact of the applied NSSs on the outcome measures of a negotiation. We conducted Fisher exact tests to examine H_{IV}**(1)** the agreement rate. We then used Mann-Whitney tests to examine hypotheses H_{IV}**(2-3)**, concerning the joint utility and the contract imbalance of the final agreement. Thereby, only dyads which reached an agreement could be analyzed. As the number of dyads in the NoDS condition was too small, hypotheses H_{IV}**(1-3)**a, b, and d, could not be verified on a quantitative basis. However, the qualitative results of those hypotheses are represented in the following. Concerning the analysis of hypotheses H_{IV}**(1-3)**c, e, and f, we calculated the exact-test-statistic, as the small sample size was too small or unbalanced within those comparisons.

5.4.1 R_{IV}(1) Agreement Rate

i) A dyad reached an agreement, when they sent an offer specified as "agreement" or, however, negotiators made clear that they both agree to the terms of their last offer (e.g. when they had problems with the use of the system). Thus, a dyad did not reach an agreement, when they sent an offer specified as "reject", or when they did not clarify that they agree with the last offer of the opponent.

ii) Hypotheses H_{IV}**(1)**a-f, concern the influence of the applied NSSs on the probability to reach an agreement. Due to the small number of dyads in the NoDS condition, hypotheses H_{IV}**(1)**a, b, and d, could not be verified on a quantitative basis. However, the qualitative results of those hypotheses are summarized in Table 5.14. Since the sample size of the other conditions was too small, Fisher exact tests were conducted, and the results are summarized in Table 5.14 as well.

Hyp.	Expectation			N		N_Agreement				N_No Agreement				χ^2	p	H
	1		2	1	2	1	[%]	2	[%]	1	[%]	2	[%]			
H_{IV}**(1)**a	BDS	>	NoDS	7	4	5	71.4%	3	75.0%	2	28.6%	1	25.0%	-	-	
H_{IV}**(1)**b	EDS	>	NoDS	19	4	12	63.2%	3	75.0%	7	36.8%	1	25.0%	-	-	
H_{IV}**(1)**c	EDS	<	BDS	19	7	12	63.2%	5	71.4%	7	36.8%	2	28.6%	0,155	0.538	~
H_{IV}**(1)**d	EDS+BDS	>	NoDS	9	4	6	66.7%	3	75.0%	3	33.3%	1	25.0%	-	-	
H_{IV}**(1)**e	EDS+BDS	>	EDS	9	19	6	66.7%	12	63.2%	3	33.3%	7	36.8%	0,033	0.600	~
H_{IV}**(1)**f	EDS+BDS	>	BDS	9	7	6	66.7%	5	71.4%	3	33.3%	2	28.6%	0,042	0.635	~

~hypothesis not confirmed

Table 5.14: Agreement rate

Analysis of all of the hypotheses H_{IV}**(1)**c, e and f show no significant differences in the comparisons of the probability to reach an agreement. Thus, all of those hypotheses are not supported by the data (p>0.10, one-tailed).

Analyzing the qualitative results, we find an average rate of agreements over all treatments of 66 %, and the highest variance amounts to 8 %. Thus, we await that quantitative tests will show a similar proportion, and therefore no significant differences between the treatment groups in the rate of agreements.

5.4.2 R_{IV}(2) Joint Utility

i) We calculate the "joint utility", as the sum of the final utility values of both negotiators in a negotiation dyad which reached an agreement. The tested variable is then computed for each negotiation dyad as follows.

$$final\ utility\ of\ negotiator\ A + final\ utility\ of\ negotiator\ B$$

ii) Hypotheses H_{IV}**(2)**a-f, concern the influence of the applied NSSs on the joint utility of the final agreement. Due to the small number of dyads in the NoDS condition, hypotheses H_{IV}**(2)**a, b, and d, could not be verified on a quantitative basis. However, the qualitative results of those hypotheses are summarized in Table 5.15. To test hypotheses H_{IV}**(2)**c, e and f, Mann-Whitney tests with, due to the small sample size, exact-test-statistics were conducted, and the results are summarized in Table 5.15.

Hyp.	Expectation 1		2	N		Median		U	Z	r	p	H
H_{IV}**(2)**a	BDS	>	NoDS	5	3	1.050	1.050	-	-	-	-	
H_{IV}**(2)**b	EDS	>	NoDS	12	3	1.050	1.050	-	-	-	-	
H_{IV}**(2)**c	EDS	>	BDS	12	5	1.050	1.050	25.0	-0.572	-0.139	0.646	~
H_{IV}**(2)**d	EDS+BDS	>	NoDS	6	3	1.040	1.050	-	-	-	-	
H_{IV}**(2)**e	EDS+BDS	>	EDS	6	12	1.040	1.050	26.5	-0.990	-0.233	0.385	~
H_{IV}**(2)**f	EDS+BDS	>	BDS	6	5	1.040	1.050	10.5	-0.849	-0.256	0.429	~

~hypothesis not confirmed

Table 5.15: Joint utility

Analysis of the hypotheses H_{IV}**(2)**c, e and f, show no significant differences in the joint utility of the final agreement. Thus, all of those hypotheses are not supported by the data (p>0.10, one-tailed).

Analyzing the qualitative results, the median position of the joint utility over all treatments amounts to 1.05 and the highest variance amounts to 0.01. Thus, we await that quantitative tests will show a similar proportion, and therefore no significant differences between the treatment groups in the joint utility.

5.4.3 R_{IV}(3) Contract Imbalance

i) We calculate the "contract imbalance", as the absolute difference between the final utility values of both negotiators in a negotiation dyad which reached an agreement. The tested variable is then computed for each negotiation dyad as follows.

$$|final\ utility\ of\ negotiator\ A - final\ utility\ of\ negotiator\ B|$$

ii) Hypotheses H_{IV}**(3)**a-f, concern the influence of the applied NSSs on the contract balance of the final agreement. Due to the small number of dyads in the NoDS condition, hypotheses H_{IV}**(3)**a, b, and d, could not be verified on a quantitative basis. However, the qualitative results of those hypotheses are summarized in Table 5.16. To test hypotheses H_{IV}**(3)**c, e and f, Mann-Whitney tests with, due to the small sample size, exact-test-statistics were conducted, and the results are summarized in Table 5.16.

Hyp.	Expectation			N		Median		U	Z	r	p	H
	1		2	1	2	1	2					
H_{IV}**(3)**a	BDS	<	NoDS	5	3	0.170	0.030	-	-	-	-	
H_{IV}**(3)**b	EDS	<	NoDS	12	3	0.110	0.030	-	-	-	-	
H_{IV}**(3)**c	EDS	>	BDS	12	5	0.110	0.170	27.5	-0.266	-0.065	0.799	~
H_{IV}**(3)**d	EDS+BDS	<	NoDS	6	3	0.045	0.030	-	-	-	-	
H_{IV}**(3)**e	EDS+BDS	<	EDS	6	12	0.045	0.110	30.0	-0.570	-0.134	0.616	~
H_{IV}**(3)**f	EDS+BDS	<	BDS	6	5	0.045	0.170	13.5	-0.275	-0.083	0.792	~

~hypothesis not confirmed

Table 5.16: Contract imbalance

Analysis of all of the hypotheses H_{IV}**(3)**c, e and f show no significant differences in the contract balance of the final agreement. Thus, hypothesis H_{IV}**(3)**f is confirmed (p>0.10, two-tailed), and hypotheses H_{IV}**(3)**c and e are not supported by the data (p>0.10, one-tailed).

Analyzing the qualitative results, the median position of the contract imbalance over all treatments amounts to 0.07 and the highest variance amounts to 0.10. Thus, we await that quantitative tests will show a similar proportion, and therefore no significant differences between the treatment groups in the joint utility.

In the following we summarize the results of the fourth part of hypotheses concerning the outcome dimensions (see Table 5.17).

Hyp	Dependent	Expectation			Results
H_{IV}**(1)**a	Agreement rate	BDS	>	NoDS	too small sample
H_{IV}**(1)**b	Agreement rate	EDS	>	NoDS	too small sample
H_{IV}**(1)**c	Agreement rate	EDS	<	BDS	no significant difference
H_{IV}**(1)**d	Agreement rate	EDS+BDS	>	NoDS	too small sample
H_{IV}**(1)**e	Agreement rate	EDS+BDS	>	EDS	no significant difference
H_{IV}**(1)**f	Agreement rate	EDS+BDS	>	BDS	no significant difference
H_{IV}**(2)**a	Joint utility	BDS	>	NoDS	too small sample
H_{IV}**(2)**b	Joint utility	EDS	>	NoDS	too small sample
H_{IV}**(2)**c	Joint utility	EDS	>	BDS	no significant difference
H_{IV}**(2)**d	Joint utility	EDS+BDS	>	NoDS	too small sample
H_{IV}**(2)**e	Joint utility	EDS+BDS	>	EDS	no significant difference
H_{IV}**(2)**f	Joint utility	EDS+BDS	>	BDS	no significant difference
H_{IV}**(3)**a	Contract imbalance	BDS	<	NoDS	too small sample
H_{IV}**(3)**b	Contract imbalance	EDS	<	NoDS	too small sample
H_{IV}**(3)**c	Contract imbalance	EDS	>	BDS	no significant difference
H_{IV}**(3)**d	Contract imbalance	EDS+BDS	<	NoDS	too small sample
H_{IV}**(3)**e	Contract imbalance	EDS+BDS	<	EDS	no significant difference
H_{IV}**(3)**f	Contract imbalance	EDS+BDS	<	BDS	no significant difference

Table 5.17: Summary of results - Outcome Analysis

5.5 R_V - Offer analysis in the pre- and post *vienNA* condition

In the fifth part of the results we analyze the hypotheses H_V**(1-2)**, concerning the impact of the applied NSSs (EDS+BDS and BDS) on the performance of negotiators before and after the first use of *vienNA*.

Thereby, only dyads which made at least one bargaining step (excluding the first offer of the negotiation) before and after the use of *vienNA*, were included in the analysis.

We used Wilcoxon signed-rank tests to analyze hypotheses H_V(1-2)a and b to compare the dependent data pre- and post *vienNA* within a condition. Furthermore, we conducted Mann-Whitney tests to test hypotheses H_V(1-2)c where we compared the performance of negotiators in both conditions after the first use of *vienNA*.

5.5.1 $R_V(1)$ Sender's utility decreasing size per bargaining step

i) We calculate the "sender's utility decreasing size per bargaining step" in the pre- and post *vienNA* phase, as ratio of the accumulated conceding value in concessions and trade-offs and the total number of used bargaining steps (excluding the first offer of the negotiation). The tested variable is then computed for each negotiator, who used at least one bargaining step before and after the use of *vienNA*, as follows.

$$\frac{accumulated\ decreased\ utility\ made\ in\ concession\ and\ trade-off\ bargaining\ steps}{number\ of\ bargaining\ steps}$$

ii) To test hypotheses H_V**(1)**a and b, Wilcoxon signed-rank tests were conducted to compare the sender's utility decreasing size per bargaining step, of users within a condition before- and after the use of *vienNA*. The results are summarized in Table 5.18.

Hyp.	Additional Support	Expectation Stages of BDS	Median pre	Median Post	Z	R	p	H
H_V**(1)**a	EDS	post > pre	0.141	0.061	-2,599	-,572	<0,01***	x
H_V**(1)b**	NoDS	post > pre	0.089	0.090	-0,303	-,068	0,36	~

***p<0.01, ~hypothesis not confirmed, xcontrary to prediction

Table 5.18: Pre-post Comparison of the sender's utility decreasing size per bargaining step

Contrary to the prediction in hypothesis H_V**(1)**a, the sender's utility decreasing size per bargaining step of users with additional EDS, is higher in the pre-*vienNA* phase than in the post-*vienNA* phase ($p< 0.01$, one-tailed).

Analysis of hypothesis H_V**(1)**b shows no significant differences in the sender's utility decreasing size per bargaining step of users without additional EDS between the pre- and post-*vienNA* phase. Thus, hypothesis H_V**(1)**b is not supported by the data ($p>0.10$, one-tailed).

To test hypothesis H_V**(1)**c, we conducted a Mann-Whitney test with, due to the small sample size, exact-test-statistic. The results are summarized in Table 5.19.

Hyp.	Index		Median		U	Z	r	p	H
	1	2	1	2					
H_V**(1)**c	EDS+BDS	< BDS	0.061	0.090	31,000	-1,438	-0,322	0,165	~

~hypothesis not confirmed

Table 5.19: Post-post comparison of the sender's utility decreasing size per bargaining step

Analysis of the hypothesis H_V**(1)**b shows no significant differences between the sender's utility decreasing size per bargaining step in the post-*vienNA* phase of users with additional EDS and users without additional support. Thus, hypothesis H_V**(1)**b is not supported by the data (p>0.10, one-tailed).

A visual inspection of the box plots in Figure 5.10 shows that in line with the results from the tests above, the median of EDS+BDS in the post-*vienNA* condition (green box) is lower than in the pre-*vienNA* condition (blue box). Furthermore, we find similar medians in the pre- and post *vienNA* condition in the BDS treatment. What is more, we find similar medians of EDS+BDS and BDS in the post-*vienNA* condition. Thus, the results of the tests above (no significant differences) in those comparisons are supported by the box plots.

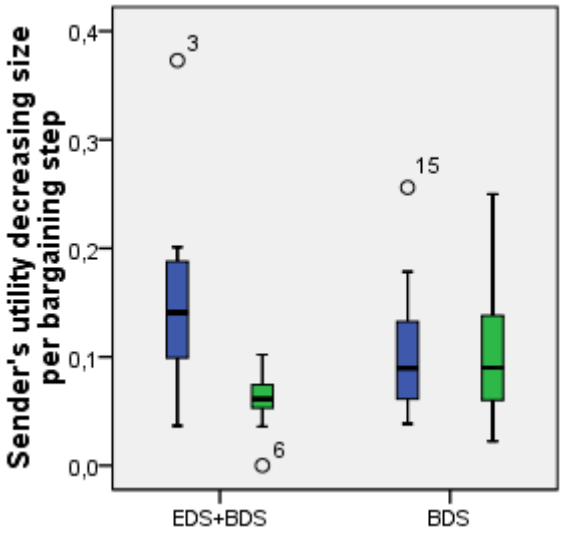


Figure 5.10: Sender's utility decreasing size per bargaining step pre- and post *vienNA*

5.5.2 R_V(2). Ratio of unconditional and total concession size

i) We calculate the relation between the "unconditional and conditional concession size" in the pre- and post *vienNA* phase (analogously to the results in R_{II}**(4)**) as ratio of the accumulated size of utility decreased in concession bargaining steps, and accumulated size of utility decreased in trade-off and concession bargaining steps. The tested variable is then computed for each negotiator, who used at least one bargaining step (excluding the first offer of the negotiation) before and after the use of *vienNA*, as follows.

$$\frac{accumulated\ size\ of\ utility\ decreased\ in\ concession\ bargaining\ steps}{accumulated\ size\ of\ utility\ decreased\ in\ concession\ +\ trade-off\ bargaining\ steps}$$

ii) To test hypotheses H_V**(2)**a and b, Wilcoxon signed rank tests were conducted to compare the performance of users within a condition before- and after the use of *vienNA*. The results are summarized in Table 5.20.

Hyp.	Additional Support	Expectation Stages of BDS	Median Pre	Median Post	Z	r	p	H
H_V**(2)**a	EDS	pre > post	1,000	0,509	-2,043	-0,457	0,021**	✓
H_V**(2)**b	NoDS	pre > post	0,872	1,000	-1,153	-0,258	0,124	~

**p<0.05, ✓hypothesis confirmed, ~hypothesis not confirmed

Table 5.20: Pre-post comparison of the ratio of unconditional and total concession size

As predicted in hypothesis H_V**(1)**a, the ratio of unconditional and total concession size of users with additional EDS, is higher in the pre-*vienNA* phase than in the post-*vienNA* phase (p< 0.05, one-tailed).

Analysis of hypothesis H_V**(1)**b shows no significant differences in the ratio of unconditional and total concession size of users without additional EDS between the pre- and post-*vienNA* phase. Thus, this hypothesis H_V**(1)**b is not supported by the data (p>0.10, one-tailed).

To test hypothesis H_V**(2)**c, we conducted a Mann-Whitney test with, due to the small sample size, exact-test-statistic. The results are summarized in Table 5.21.

Hyp.	Index 1	Index 2	Median 1	Median 2	U	Z	r	p	H
H_V**(2)**c	EDS+BDS	BDS	0.509	1.000	37,000	-1,059	-0,237	0,353	~

~hypothesis not confirmed

Table 5.21: Post-post comparison of the ratio of the unconditional and total concession size

Analysis of hypothesis H_V**(2)**c shows no significant differences in the ratio of unconditional and total concession size in the post-*vienNA* phase between users with additional EDS and users without additional support. Thus, hypothesis H_V**(2)**c is not supported by the data (p>0.10, one-tailed).

A visual inspection of the box plots in Figure 5.11 shows that in line with the results from the tests above, the median of EDS+BDS in the post-*vienNA* condition (green box) is lower than pre-*vienNA* condition (blue box). Furthermore, we find similar medians in the pre- and post *vienNA* condition in the BDS treatment. What is more, we find a very high range of scores of EDS+BDS and BDS in the post-*vienNA* condition. Thus, the results of the tests above (no significant differences) in those comparisons are supported by the box plots.

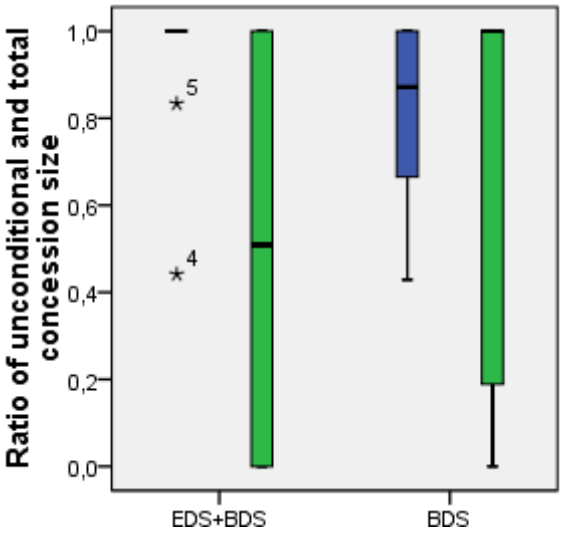


Figure 5.11: Ratio of unconditional and total concession size pre- and post *vienNA*

In the following we summarize the results of the fifth part of hypotheses in Table 5.22 and Table 5.23, concerning the pre/post and post/post *vienNA* comparison.

Hyp	Dependent	Additional Support	Expectation	Results
H_V**(1)**a	Sender's utility decreasing size per bargaining step	EDS	pre < post	p<0.01 contrary to prediction
H_V**(1)**b	Sender's utility decreasing size per bargaining step	NoDS	pre < post	no significant difference
H_V**(2)**a	Ratio of unconditional and total concession size	EDS	pre > post	p<0.05
H_V**(2)**b	Ratio of unconditional and total concession size	NoDS	pre > post	no significant difference

Table 5.22: Summary of results - pre/ post *vienNA* comparison

Hyp	Dependent	Expectation	Results
H_V**(1)c**	Sender's utility decreasing size per bargaining step	EDS+BDS < BDS	no significant difference
H_V**(2)c**	Ratio of unconditional and total concession size	EDS+BDS > BDS	no significant difference

Table 5.23: Summary of results - post/ post *vienNA* comparison

6 Discussion, Conclusion, and Outlook

6.1 Discussion of Results

In the following part, we summarize the presented results and discuss the impact of different support approaches on the concession behavior of negotiators. Thereafter, we will again stress the limitations that restrain our findings.

In our thesis, we examined whether the economic and/or behavioral support approaches (alone or in combination) have an impact on the concession behavior of negotiators. Thereby, we observed the negotiation process and various outcome dimensions in relation to the negotiation dilemma. In doing so, we predicted that the economic approach helps parties to reach their individual goals and to increase the efficiency of the negotiation- while the behavioral approach was expected to increase the probability to reach an agreement (effectiveness of a negotiation). We divided our hypotheses in five sections: i) Offer Structure, ii) Offer Direction, iii) Offer Quality, iv) Outcome Analysis and v) pre- and post *vienNA* comparison.

i) In the first part of our hypotheses, we examined whether the "Offer Structure" of negotiators is influenced by the applied support approaches. In more detail, we observed the use of complete offer packages and the progressive modification of offer packages during the negotiation process. Therein, we expected that the use of complete offer packages and the higher diversity of ongoing offers provide a basis for an appropriate negotiation climate- where negotiators are flexible and open to make concessions, and move toward the opponent. Thereby, we expected this negotiation climate not to evoke a desperate negotiation dilemma.

We hypothesized that users with EDS will prepare more "complete first-offer packages" than users without such support. This was reasoned by a longer preparation time, and an instant evaluation of prepared offer packages in the EDS conditions. In line with our prediction, our findings showed that users in the EDS condition use significantly more complete first-offer packages than users in the NoDS condition, while other comparisons showed no significant differences.

In the "number of proposed contracts", we hypothesized that the use of BDS leads to a lower number of proposed contracts, as we expected that

negotiators are induced to exchange more priority information within an offer. On the other hand, we assumed that users with EDS focus more on the individual utility of the exchanged offers and thereby, exchange priority information more slowly and implicitly within a higher number of exchanged offers. However, we found only one significant result, as according to our prediction, users in the combined condition EDS+BDS proposed a lower number of contracts than users with EDS. This indicates that the use of EDS and BDS in combination can shorten the duration of a negotiation compared to the sole use of either one system.

In the "generation of alternative offer packages", we considered the support of users to manage the cognitive load when offering alternative offer packages, i.e. how negotiators are aided by different support systems to change values in different issues simultaneously between two subsequent offers. Therein, we hypothesized that users with NoDS will change fewer values than users with BDS or EDS, as they were neither advised on how to move from initial positions and to engage in logrolling offers (BDS), nor did they have access to an instant offer evaluation (EDS). However, we found no significant differences in any comparison between the different treatment groups. Thus, the results are consistent that there is no significant impact of neither EDS, nor BDS, or the use of both in combination, on this particular issue. Therefore, we assume that the cognitive load of negotiators in this issue is not significantly aided by any supplied support approach of this study. A possible explanation for this non-impact of decision support can be the asynchronous conduction of negotiations in the setting of the experiment. Thereby, negotiators had a lot of time to prepare offer package and the cognitive load was then lower than compared to negotiations under a higher time pressure.

In Table 6.1, we summarized the significant results of the first part of tested hypotheses, concerning the Offer Structure.

ii) In the second part of our hypotheses, we examined whether the "Offer Direction" of negotiators is influenced by the applied support approaches. In more detail, we observed the use of concessions and trade-offs, and the frequency and size of sender's (receiver's) utility decreasing (increasing) offers during the negotiation process. Therein, we observed whether the use of the applied support

approaches leads to a specific use of bargaining steps, which possibly aids negotiators to cope with the negotiation dilemma.

We hypothesized that users with EDS or BDS use relatively more "concessions and trade-offs" than users with NoDS. In doing so, we expected that the ease of application by the instant offer evaluation (EDS), or the advice on how to move from initial positions (BDS), will increase the number of concessions and trade-offs. However, we found no significant differences in any comparison between the different treatment groups. Thus, the results are consistent that there is no significant impact of neither EDS, nor BDS, or the use of both in combination, on the use of concessions and trade-offs.

In the frequency and size of sender's (receiver's) utility decreasing (increasing) offers, we examined the relative number and size of offers, where the offer sender's (receiver's) utility value is decreased (increased). Concerning the negotiation dilemma, we expected that users with EDS will propose more- but smaller offers, while users with BDS were predicted to take larger steps toward the opponent. However, we found no significant differences in any comparison between the different treatment groups. Thus, the results are consistent that there is no significant impact of neither EDS, nor BDS, or the use of both in combination, on the frequency and size of sent and received concessions.

In the "ratio of unconditional and total concession size" we analyzed whether negotiators decreased their utility either in using concession, or trade-off bargaining steps. Therein, we expected that users that the advice of BDS to search for mutual benefits, will increase the size of conditional concessions. Only one comparison of treatment groups showed significant differences. Contrary to our prediction, we found that users in the combined condition EDS+BDS use in relation more unconditional than conditional concessions, compared to users with EDS. This shows that the use of EDS in combination with BDS, aids negotiators to move from initial positions and to decrease the own value consistently in an issues without demanding concessions in other issues, in comparison to the sole use of EDS.

In summary, most of the results of the second part of hypotheses did not show any significant differences. This implicates that neither EDS nor BDS alone,

or in combination has a significant impact on the frequency or the size of made concessions. Only one comparison of the use of unconditional and conditional concession showed significant differences and the result is presented in Table 6.1.

iii) In the third part of our hypotheses, we examined whether the "Offer Quality" of negotiators is influenced by the applied support approaches. In more detail, we observed the frequency of sender's utility decreasing offers with a positive joint value during the negotiation process. Therein, we examined whether the use of the applied support approaches aids users to create offer packages with a mutual benefit- which is then expected to prevent or alleviate the negotiation dilemma.

In the "sender's utility decreasing offers with a positive joint value", we took a closer look on made concessions and the impact on the joint value for both negotiators. Therein, we found that users in the combined condition EDS+BDS use relatively more of such offers than users with EDS and users with NoDS (although we have to mention that the average size of such offers of users with NoDS was significantly higher than those of EDS+BDS). This indicates that the use of EDS and BDS in combination increases the awareness of mutually beneficial solutions compared to the sole use of EDS. In Table 6.1, we summarized the significant results of the third part of tested hypotheses.

iv) In the fourth part of hypotheses, we analyzed whether the different support approaches have an impact on the most prominent outcome measures. Concerning the negotiation dilemma, we expected that negotiators with economic support propose fewer concessions to increase the final individual utility- and negotiators with behavioral support were expected to propose more concessions to increase the probability to reach an agreement.

Although we could not test all comparisons in a quantitative way (only 26 dyads reached an agreement), both quantitative, and qualitative observations, showed no significant differences in the "Rate of Agreements", the "Joint Utility", and the "Contract Imbalance" of an agreement between the treatment groups. This implicates that even though we had already found significant differences between the treatment groups in the process of the negotiation-, the different support

approaches had no significant impact on the effectiveness, efficiency or fairness of the outcome of a negotiation.

v) In the fifth part of hypotheses, we observed the pre-post *vienNA* performance of users *within* the BDS conditions (EDS+BDS, and BDS). Thereby, we compared the concession behavior of negotiators before- and after the first use of *vienNA*. What is more, we analysed the post-post performance *between* the two treatment groups, after the first use of *vienNA*.
We expected that BDS leads to a higher understanding for the opponents' needs and interests. Thereby we predicted that users in this condition show a greater flexibility to move from initial positions and propose various alternative solutions. In doing so, we awaited that a probably evoked negotiation dilemma could be alleviated.

When we compared the “sender’s utility decreasing size per bargaining step” and the “ratio of unconditional and total concession size” (each within a condition between the pre- and post *vienNA* phase as well as the post/post comparison between the two treatment groups) we did only find significant differences in the pre- and post *vienNA* comparison of the combined condition EDS+BDS.
Therein, contrary to our prediction, we found that users in the EDS+BDS condition use a significantly higher "sender's utility decreasing size per bargaining step" in the pre-*vienNA* condition than compared to the post-*vienNA* condition. This indicates, that users with EDS progress faster towards each other before the use of *vienNA*. Therefore, a possible explanation can be that negotiators with EDS are aware of their reservation levels right from the beginning of the negotiation and can therefore decrease their own utility consistently with larger steps. At the time when negotiators meet their reservation levels, the progress of the negotiation is slowed down. Thus, we assume that users with EDS use BDS just when the phase of negotiation becomes more critical.
A possible reason for the non significant result in the sole BDS condition can be that within this condition, negotiators used *vienNA* in a later stage of the negotiation process (2,5 bargaining steps (median) before the first use of *vienNA*, and 1 bargaining step after the first use of *vienNA*, p= 0.13 one-tailed; – compared

to users in the EDS+BDS condition, who proposed 2 bargaining steps before- and 2 bargaining steps after the first use of *vienNA*, p= 0.38 one-tailed).

When we analyzed the "ratio of unconditional and total concession size" before and after the use of *vienNA*, we awaited in both conditions a lower ratio of unconditional concessions after the use of *vienNA*. Therein, negotiators with EDS+BDS used a higher ratio of unconditional and total concessions in the pre-*vienNA* phase. This indicates, that the advice of *vienNA* to use trade-offs does have an impact on the search for alternative solutions of users with additional EDS. A limitation of this finding is the correlation of the use of different bargaining steps and the time of point in a negotiation. It was found that the frequency of trade-offs increases over the duration of the negotiation (Filzmoser and Vetschera 2008). Thus, the mere use of unconditional concessions after *vienNA*, is not necessarily the sole impact of *vienNA*, but also possibly contingent on the point of time of the negotiation progress.

In Table 6.2, we summarized the significant results of the fifth part of tested hypotheses, where we compared the performance before and after the use of *vienNA*.

Hyp	**Dependent**	**Results**		
H_I**(1)**b	Complete first-offer packages	EDS	> NoDS	p<0.05
H_I**(2)**e	Number of proposed contracts	EDS+BDS	< EDS	p<0.05
H_{II}**(4)e**	Ratio of unconditional and total concession size	EDS+BDS	> EDS	p<0.10
H_{III}**(1)**d	Frequency of positive sender's utility decreasing offers	EDS+BDS	> NoDS	p<0.10
H_{III}**(1)**e	Frequency of positive sender's utility decreasing offers	EDS+BDS	> EDS	p<0.05

Table 6.1: Significant Results, H_I-H_{IV}

Hyp	**Dependent**	**Additional Support**	**Results**	
H_V**(1)**a	Sender's utility decreasing size per bargaining step	EDS	pre > post	p<0.01
H_V**(2)**a	Ratio of unconditional and total concession size	EDS	pre > post	p<0.05

Table 6.2: Significant Results, H_V

To define the validity of the above presented results, we have again to mention some limitations that restrain our findings.

i) Although we calculated exact test statistics for to examine small or unbalanced comparisons, the general validity of the results is limited by the small sample size

and unbalanced number between the different treatment groups. ii) Concerning the analysis of the negotiation process, concession patterns differ whether a negotiation reached an agreement or not. However, we did not distinguish between negotiators which reached an agreement or not, as the agreement rate showed no significant differences between the treatment groups, and the sample size would have been too small if we had excluded the dyads which did not reach an agreement. iii) We used only the information of formal offers (i.e. utility values) and excluded all informal offers (request messages and clarifications). iv) The negotiation case created a high level of conflict on the substantive level, as most issues offered only a small ZOPA. v) In the underlying study, only students with different negotiation skills and backgrounds participated in the experiment. However, students represent " a sample of future managers who will probably have to deal with this new technology" (Koeszegi, et al. 2006, p. 30). In the following, we will discuss the results under the awareness of the above-mentioned limitations of the study.

6.2 Conclusion

In the concluding chapter of our thesis we discuss the general impact of our findings.

The aim of our study was to analyze the impact of economic and behavioral support approaches on the concessive behavior of negotiators. Furthermore, we observed whether the use of different support approaches aids negotiators to solve the negotiation dilemma. Therein, we examined the effect on negotiators of both support approaches alone- as well as when combined together. In doing so, we used quantitative and qualitative methods, to get an deeper insight into the impact of the applied support systems on the structure, frequency, size and quality of different bargaining steps. What is more, we observed various outcome dimensions and investigated the use of bargaining steps before- and after the usage of BDS.

Along our hypotheses, we expected that both approaches have an impact on the negotiation dilemma. Therein, we assumed that EDS will lead to a higher efficiency- while BDS will leads to a higher effectiveness of negotiations. In more detail, we expected that EDS increases the cognitive ability to propose complete offer packages and to modify the solutions along the negotiation process. In more

detail, on the one hand, we assumed that negotiators with EDS propose more- but smaller concessions to increase the individual utility (efficiency). On the other hand, we expected that BDS increases the understanding for the opponents' needs and interests. Thereby, we expected a higher exchange of priority information and a positive relationship between the negotiators in this condition. Concerning the concession analysis and the negotiation dilemma, we then awaited that negotiators with BDS will propose larger concessions and move faster towards each other. Thus, we then expected that the probability to reach an agreement (effectiveness) is increased.
In the combined condition EDS+BDS, we expected that the combination of economic and behavioral support aids negotiators to bring in line the efficiency and effectiveness of a negotiation and thereby, helps to deal with the negotiation dilemma.

However, in our analysis, we found that most of our tests did not show any significant differences between the treatment groups.

Concerning the basic use and structure of offers, we found that users with EDS used more complete first-offer packages than users with NoDS. This is in line with earlier findings where it is supposed that users with EDS use a longer preparation time and prepare various complete offer packages before the start of the negotiation (Koeszegi, et al. 2006). Furthermore, we found an impact on the number of proposed contracts. Therein, users with EDS+BDS proposed fewer contracts than users with EDS only. We assume that this is reasoned due to a higher explicit exchange of priority information within a message due to the advice of BDS, as it was expected that tactical advice influences the behavior of negotiators (Weingart, et al. 1996).
What is more, our results show that the frequency and size of conceding offers is not significantly influenced by any support approach. A possible explanation can be the low integrative potential of the negotiation case. Therein, negotiators faced a small ZOPA where they had to concede step by step towards each other in all issues, while it was barely possible to propose value-creating trade-off offers.
Regarding the size of conditional and unconditional concessions, we found that users in the combined condition EDS+BDS made in relation more unconditional concessions than users with EDS only. We assume that this is reasoned through a

higher understanding of the opponents' needs by BDS- combined with the aid of EDS to concede towards each other in all issues without demanding concessions in other issues, while being aware of the own utility.

Concerning the use of the "right concessions" (Gettinger, et al. 2012a) we found that users with EDS+BDS used more concessions with a positive joint value for both negotiators than users with EDS and users with NoDS. We again assume that this is reasoned due to the combination of the awareness of the own preferences (EDS) and the understanding of the opponents' needs (BDS). Thereby, negotiators are able to propose offers where the gain of utility by one party is higher than the loss of utility by the other party.

As stated above, we found significant differences between the treatment groups during the negotiation process. However, the outcome measures "Agreement Rate", "Joint Utility" and "Contract Imbalance" did not show any significant differences. This implicates that although we found significant differences between the different treatment groups during the negotiation process- we did not find a major support approach which stands out from other approaches.

In the comparison of the concession behavior before and after the use of the BDS tool *vienNA* we compared the size and type of used concessions. Thereby, we did only find significant differences in the combined condition EDS+BDS. In more detail, we found that negotiators with EDS+BDS use a higher concession size in the pre-*vienNA* phase than compared to the post-*vienNA* phase. Furthermore we found that users in this condition concede more in using unconditional concession in the pre-*vienNA* phase than compared to the post-*vienNA* phase. Thus, we assume that EDS aids negotiators to progress faster towards each other in the beginning of the negotiation, and then supports negotiators to implement the advice of BDS to make use of conditional concessions in the later stage of the negotiation.

Overall, we found that the sole use of the mediation tool *vienNA* did not show any impact on the concession behavior of negotiators- neither in the comparison of treatments, nor in the phase-analysis before and after the use of *vienNA*. However, a possible area of research for future studies, can be the pro-active (see also 6.3) use of a mediation software, although this is against the paradigm of mediation- as mediation should be used by one's own choice (Druckman, et al. 2004).

On the whole, our findings lead to the following implications for upcoming research. We found various differences in the concession behavior of users in the combined condition EDS+BDS compared to users in the EDS condition, and users in the NoDS condition. However, we did not find significant differences of the sole use of BDS. This suggests that the use of BDS alone or the implementation in the system is not mature yet. Another possible explanation can be that negotiators do not want to leave the control over the negotiation process to a computer (Druckman, et al. 2004). Maybe, the acceptance of external aid is higher, when there is already a form of decision support applied from the beginning of the negotiation (as it is the case in the EDS+BDS condition), or when a form of pro-active mediation support is supplied. Furthermore, the applied negotiation case in this study discussed a conflict which was merely based on a substantive level. Thus, a further explanation of the non impact of the sole use of BDS can possibly be that this high substantive level of conflict was not appropriate for mediation support.

6.3 Outlook

Overall, the study contributes to gain a deeper insight into the impact of economic and behavioral decision support systems, on the concession behavior of negotiators. At last, we would like to make a few suggestions for future research and upcoming studies.

i) integrative potential of the negotiation case: To investigate the influence of economic and behavioral support approaches, the impact could be examined in a negotiation case with a higher integrative potential. Thereby, we assume that in a negotiation case with more integrative potentials in a few issues, behavioral and economic decision support can aid negotiators to identify these potentials. Thus, different advantages of the applied support approaches can possibly made more visible.

ii) time pressure: In a negotiation setting with a higher time pressure, the cognitive load for negotiator is possibly higher. Thereby, we assume that the applied support approaches could then have a greater impact on the concession behavior of negotiators.

iii) sample size: In a larger sample the frequency and size of "sent" and "received" concessions could be compared whether an agreement has been reached or not. As the presented negotiation case has a high level of conflict and strictly opposing preferences, the range of concessions and the decrease of utility values depends on whether an agreement has been reached or not.

iv) method of analysis: In a forthcoming study, we can apply other methods of analysis on the already collected data. Using an example, we can analyse the progress of the quality of bargaining steps over time (i.e. the mutual benefits for both negotiators). In more detail, we can then observe, how different support approaches influence the point of time, when different bargaining steps (especially value creating bargaining steps) are taken.

v) pro-active facilitative systems: In the underlying study, both applied support systems are dedicated as active facilitative support systems. We assume that both, advantages and possible disadvantages of the applied decision support systems could be made more visible when applied as pro-active facilitative system (e.g. "Aspire" (Kersten and Lo 2003).

vi) individual differences: The applied support approaches can be examined in the context of the individual social value orientation. Thereby, we can observe whether different support systems enhance or counteract a specific social value orientation of negotiators (Curhan, et al. 2010).

References

Bosse, T., Jonker, C. M., and Treur, J. (2004): Experiments in Human Multi-Issue Negotiation: Analysis and Support. In: Proceedings of the Third International Joint Conference on Autonomous Agents and Multiagent Systems, Vol. 2. New York, New York: IEEE Computer Society: pp. 671-678.

Brandmayr, T., and Okruch, R. (2011): Influence of Negotiation Support Systems on the Behavior of Negotiators and on Outcome Dimensions Master thesis, Department of Labor Science and Organization, Vienna University of Technology.

Carnevale, P. J., and Pruitt, D. J. (1992): Negotiation and Mediation. Annual Review of Psychology 43: pp. 531-582.

Chen, E. (2006): Collaborative and Competitive E-Negotiations: An Analysis of Communication Modes on Concessions. InterNeg Research Paper: pp. 1-22.

Curhan, J. R., Elfenbein, H. A., and Eisenkraft, N. (2010): The Objective Value of Subjective Value: A Multi-Round Negotiation Study Journal of Applied Social Psychology 40: pp. 690-709.

Delaney, M. M., Foroughi, A., and Perkins, W. C. (1997): An Empirical Study of the Efficacy of a Computerized Negotiation Support System (NSS). Decision Support Systems 20(3): pp. 185-197.

Druckman, D., Druckman, J. N., and Arai, T. (2004): E-Mediation: Evaluating the Impacts of an Electronic Mediator on Negotiation Behavior. Group Decision and Negotiation 13: pp. 481-511.

Druckman, D., Ramberg, B., and Harris, R. (2002): Computer-Assisted International Negotiation: A Tool for Research and Practice. Group Decision and Negotiation 11(3): pp. 231-256.

Field, A. (2009): Discovering Statistics Using Spss, London: Sage Publications Inc.

Filzmoser, M., and Vetschera, R. (2008): A Classification of Bargaining Steps and Their Impact on Negotiation Outcomes. Group Decision and Negotiation 17(5): pp. 421-443.

Filzmoser, M., and Vetschera, R. (2012): The (Non-) Impact of Support on Offer Processes in Electronic Negotiations, In: Almeida A., Morais, D., and S. Daher (Eds): Proceedings of the International Conference on Group Decision and Negotiation (2012), Vol. 1, Brazil, Brazil: pp. 75-76.

Foroughi, A. (1998): Minimizing Negotiation Process Losses with Computerized Negotiation Support Systems. Journal of Applied Business Research 14(4): pp. 15-26.

Foroughi, A., and Jelassi, M. T. (1990): NSS Solutions to Major Negotiation Stumbling Blocks, in Proceedings of the 23rd Hawaii Conference on System Science, Kailua-Kona, Hawaii: pp. 2-11.

Foroughi, A., Perkins, W. C., and Jelassi, M. T. (1995): An Empirical Study of an Interactive, Session-Oriented Computerized Negotiation Support System (NSS). Group Decision and Negotiation 4(6): pp. 485-512.

Gettinger, J., Dannenmann, A., Druckman, D., Filzmoser, M., Mitterhofer, R., Reiser, A., Schoop, M., Vetschera, R., Wijst, P. V. D., and Koeszegi, S. (2012a): Impact of and Interaction between Behavioral and Economic Decision Support in Electronic Negotiations. In: Hernandez J.E., Zarate P., Dargam F., Delibasic B, Liu S. and Ribeiro R. (eds): Lecture Notes in Business Information Processing - Collaboration in Real Environments. Springer: pp. 151-165.

Gettinger, J., and Koeszegi, S. (2012): Far from Eye, Far from Heart: Analysis of Graphical Decision Aids in Electronic Negotiation Support. Group Decision and Negotiation, online first: pp. 1-31.

Gettinger, J., Koeszegi, S. T., and Schoop, M. (2012b): Shall We Dance? - the Effect of Information Presentations on Negotiation Processes and Outcomes. Decision Support Systems 53(1): pp. 161-174.

Henderson, M. D., Trope, Y., and Carnevale, P. J. (2006): Negotiation from a near and Distant Time Perspective. J Pers Soc Psychol 91(4): pp. 712-729.

Hyder, E. B., Prietula, M. J., and Weingart, L. R. (2000): Getting to Best: Efficiency Versus Optimality in Negotiation. Cognitive Science 24(2): pp. 169-204.

Kersten, G. E. (2005): E-Negotiation Systems: Interaction of People and Technologies to Resolve Conflicts. Magnus J Manage 1(3): pp. 71-96.

Kersten, G. E. (2010): Negotiations and E-Negotiations: Management and Support: unpublished book.

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

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

Kersten, G. E., and Noronha, S. J. (1998): Rational Agents, Contract Curves, and Non-Efficient Compromises. IEEE Systems, Man, and Cybernetics 28(3): pp. 326-338.

Koeszegi, S., and Vetschera, R. (2010): Analysis of Negotiation Processes, In: Kilgour D. M. And Eden C. (eds): Handbook of Group Decision and Negotiation, Advances in Group Decision and Negotiation 4. Springer: pp. 121-138.

Koeszegi, S. T., Filzmoser, M., Gettinger, J., and Mitterhofer, R. (2011): Development and Implementation of Vienna 2.0, Technical Report, Unpublished.

Koeszegi, S. T., Filzmoser, M., Gettinger, J., and Vetschera, R. (2009): Perspectives on Eletronic Negotiation Support, In: Kilgour D M and Qwang (eds): Proceedings of the International Conference on Group Decision and Negotiation, Canada, Wilfrid Laurier University, Waterloo, 2009: pp. 105-107.

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

Lim, L.-H., and Benbasat, I. (1992-93): A Theoretical Perspective of Negotiation Support Systems. Journal of Management Information Systems 9(3): pp. 27-44.

Mitterhofer, R., Druckman, D., Filzmoser, M., Gettinger, J., Schoop, M., and Koeszegi, S. T. (2012): Integration of Behavioral and Analytic Decision Support in Electronic Negotiations, In: Sprague, R.H. Jr. (Eds.): Proceedings of the 45th Annual Hawaii International Conference on System Sciences, Maui, Hawaii, Ieee Computer Society Press, Los Alamitos California: pp. 610-617.

Perkins, W. C., Hershauer, J. C., Foroughi, A., and Delaney, M. M. (1996): Can a Negotiation Support System Help a Purchasing Manager? International Journal of Purchasing and Materials Management 32(2): pp. 37-45.

Pruitt, D. G. (2002): Strategy in Negotiation. In: Kremenyuk V. (eds): International Negotiation: Analysis, Approaches, Issues. San Francisco: Jossey-Bass: pp. 85-96.

Raiffa, H., Richardson, J., and Metcalfe, D. (2002): Negotiation Analysis. The Science and Art of Collaborative Decision Making: The Belknap Press of Harvard University Press.

Rangaswamy, A., and Shell, G. R. (1997): Using Computers to Realize Joint Gains in Negotiations: Towards an "Electronic Bargaining Table". Management Science 43(8): pp. 1147-1163.

Salo, A., and Hämäläinen, R. P. (2010): Multicriteria Decision Analysis in Group Decision Processes. In: Kilgour, D. M. And Eden, C. (eds): Handbook of Group Decision and Negotiation, Springer: pp. 269-283.

Schoop, M. (2004): The Worlds of Negotiation: In: Aakhus M. and Lind M. (eds): Proceedings of the 9th International Working Conference on the Language Action Perspective on Communication Modeling (LAP 2004), New Brunswick, USA: pp. 179-196.

Schoop, M. (2010a): Negotiation and Simulation, Course Material, Vienna University of Technology, Unpublished.

Schoop, M. (2010b): Support of Complex Electronic Negotiation, In: Kilgour D. M. And Eden C. (Eds): Handbook of Group Decision and Negotiation, Advances in Group Decision and Negotiation Vol. 4, Springer: pp. 409-423.

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

Stuhlmacher, A. F., and Champagne, M. V. (2000): The Impact of Time Pressure and Information on the Negotiaiton Process and Decisions. Group Decision and Negotiation 9: pp. 471-491.

Teich, J. E., Wallenius, H., and Wallenius, J. (1994): Advances in Negotiation Science. Transactions in Operational Research 6: pp. 55-94.

Wall, J. A., and Dunne, T. C. (2012): Mediation Research: A Current Review. Negotiation Journal, Backwell Publishing Inc 28(2): pp. 217-244.

Weingart, L. R., Hyder, E. B., and Prietula, M. J. (1996): Knowledge Matters: The Effect of Tactical Descriptions on Negotiation Behavior and Outcome. Journal of Personality and Social Psychology 70(6): pp. 1205 - 1217.

Wilkenfeld, J., Kraus, S., Holley, K. M., and Harris, M. A. (1995): Genie: A Decision Support System for Crisis Negotiations. Decision Support Systems 14: pp. 369-391.

Zartman, I. W. (2002): The Structure of Negotiation. In: Kremenyuk V. (eds): International Negotiation: Analysis, Approaches, Issues. San Francisco, Jossey-Bass: pp. 71-84.