

Integration of behavioral and analytic decision support in electronic negotiations

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Abstract

This paper presents the e-Nego-motion research project which attempts to enhance understanding of effects of and interaction between behavioral and analytic decision support in e-negotiations. Systems providing both kinds of decision support were used in a laboratory experiment. Analyses show that behavioral decision support is requested most often for issues where experienced conflict is high. When consulted early in the negotiation phase, the diagnosis, analysis and advice functions of behavioral support increase the efficiency of agreements. This effect is even stronger, when analytic decision support is available to subjects. Additionally, communication patterns influence the quality of negotiations independent of decision support. The more formal offers and counteroffers are exchanged, the higher is the efficiency of outcomes measured by joint utility. Overall, there are no significant differences in the number and quality of agreements between support approaches. Nevertheless, the satisfaction of subjects with process and outcomes reflects the strengths of the support approaches: subjects with behavioral support are most satisfied with outcomes while subjects with decision support are most satisfied with the negotiation process.

1. Introduction

According to the Montreal taxonomy electronic negotiations are "... restricted by at least one rule that affects the decision-making or communication process, if this rule is enforced by the electronic medium supporting the negotiation, and if this support covers the execution of at least one decision-making or communication task" [30, p. 147]. Such electronic Negotiation Support (eNS) systems have been

developed, implemented and studied since the early 1980s. In the 1990s, Lim and Benbasat envisioned two major components, decision and communication support for electronic negotiations [18]. A considerable variety of support systems are available [16, 18, 29, 32]. Among other dimensions, the *degree of system intervention* as well as the *type of support* vary between systems. Regarding the *degree of system intervention*, Kersten and colleagues [16, 14] distinguish between three types of systems: (i) Passive facilitative systems support communication and interaction of dispersed negotiators and provide tools to present, store, organize, and retrieve information. They do not provide a structure for the negotiation process nor intervene into the behavior of negotiators. (ii) Active facilitative systems assist negotiators in structuring the negotiation problem as well as the negotiation process. They are typically based on prescriptive decision and negotiation analysis models. (iii) Finally, proactive mediation systems allow not only the monitoring and coordinating of the negotiation process and the negotiators' activities, but also the provision of advice. The functionalities of these systems resemble those of a human mediator [13, 5]. To date, the majority of implemented systems, except for example *Aspire* [14] and *eAgora* [2], are not yet surpassing the functionalities of active facilitative systems.

With regard to *type of support*, systems follow different "support philosophies" rooted in distinct fundamental approaches to decision making [24]. A support philosophy implemented in many eNS is decision and negotiation analysis [25, 15, 3]. As a prescriptive approach, decision and negotiation analysis is concerned with how individuals can maximize their own outcomes by simultaneously realizing collaborative decisions. Furthermore, eNS with analytic decision and negotiation support typically

follows a process model of negotiations and partially determines the problem solving process by introducing machine-induced communication patterns. The features of the majority of eNS developed within this approach were mostly selected to improve the efficiency of the outcomes of negotiations, without paying attention to other dimensions such as relationship and trust between the negotiators or fairness.

In contrast, behavioral decision making is a descriptive negotiation approach and is concerned with how individuals *actually make* decisions [25]. Most often rooted in the domain of social psychology and political or management science, behavioral decision theorists are interested in understanding how and why individuals act in negotiations. The less tangible - socio-emotional - aspects of negotiations such as the establishment of a personal relationship and trust between negotiators as well as a good negotiation climate are relevant [17, 20, 21, 10, 19, 11]. With a deep understanding of socio-emotional dynamics, it is possible to predict negotiation behaviour and outcomes and to help negotiators to overcome difficulties and obstacles arising during negotiation processes. Systems providing advice in this support approach, like the e-mediation system *Negotiator Assistant (NA)* [6], are often process focused and designed to direct the behavior of negotiators toward relationship and trust building, flexibility, and fairness. All of these qualities are suited to increase the prospects of a lasting agreement.

Two different outcome dimensions, namely high quality of agreement (efficiency) and high prospects of reaching an agreement (effectiveness) are found to be conflicting objectives: Aspects positively influencing the quality of agreements, simultaneously decrease the prospects of reaching an agreement at all [22, 33, 8] – a phenomenon called the negotiation dilemma. Depending on the support philosophies of system designers, existing eNS focus on either dimension. A combination of systems supporting both objectives simultaneously is missing so far. Therefore we lack knowledge about whether a combination of support philosophies could help to overcome the negotiation dilemma.

The focus of the e-*Nego*-motion research project is on the systematic comparison of the effects of the two alternative support approaches: analytic and behavioral decision support on several negotiation process and outcome dimensions. We developed *vienNA*, an e-mediation system based on main functions of *NA* for behavioral decision support [7] and used it in combination with *Negoisst*, a system offering both analytic decision support and communication support [26] in a laboratory study. The aim of this project is to broaden the perspective of negotiation support in an

attempt to enhance the understanding of the impact of the two approaches to decision support mentioned above.

The remainder of the paper is structured as follows: Section 2 discusses the background on behavioral and analytic decision support. Section 3 introduces the systems. Section 4 presents information about the method, and Section 5 presents results of data analyses. Finally, Section 6 concludes the paper with a discussion and an outlook on future research.

2. Background

This study analyzes the effects of two basic and very distinct negotiation support philosophies. The first, negotiation analysis, aims to avoid suboptimal trade-offs or lost opportunities that prevail in face-to-face negotiations [23, 27]. Negotiation analysis uses formal representations and analytic models from other fields such as economics, game theory, and decision analysis. eNS that follow an analytic negotiation approach such as *Inspire* [15], *Negoisst* [26] or *Smart Settle* [31] aim at improving the efficiency of negotiations by providing support to all of its phases: preparation, conduct, and post-settlement. In the preparation phase, issues and options of the negotiation problem are identified; the negotiators' preferences over the possible agreements are elicited and formally represented by a utility function. In the conduct phase, the eNS provides a protocol for the exchange of formal offers, including an evaluation and graphical illustration of offers and counter-offers according to the preferences of the negotiator. Finally, in a post-settlement phase the eNS proposes Pareto-improvements to a tentative agreement reached by the negotiating parties, thereby ensuring Pareto-efficiency of the outcome so that no value is left on the bargaining table.

To date, a considerable amount of empirical studies compares the effects of analytic negotiation support with face-to-face negotiations and the majority confirms its positive effects on outcomes of negotiations. Compared to face-to-face negotiations, analytic support leads to better joint outcomes as well as more equity and fairness [12, 15, 1, 31]. Koeszegi et al. [17] compare electronic negotiations conducted with two different systems, *Inspire* offering both analytic decision and negotiation support and *SimpleNS* offering communication support only. They also find that analytic decision support increases concession making and decreases the use of hard tactics. Overall, additional decision support leads to a higher number of agreements than communication support only.

The second support approach of e-mediation has its roots in behavioral social psychology and was developed by Daniel Druckman and his colleagues [5, 6, 4]. It intends to overcome impasse situations by increasing the negotiating parties' flexibility, namely, their willingness to move away from initial positions or the discovery of new solutions to dividing issues. Systems providing e-mediation support call attention to the benefits of conducting mediation tasks by means of information technology and electronic communication. e-mediation allows for a timely monitoring and diagnosis of the progress of a negotiation, because information technology can perform complex analyses in real time, identify problems, and provide advice to solve them. *NA* incorporates the main mediation activities of diagnosis, analysis and advice [5, 6]. In the diagnosis phase, *NA* gathers information about key aspects of the negotiation that influences the negotiators' flexibility. This information is aggregated to flexibility measures used to forecast the outcome of the negotiation based on its current status. The analysis and advice functions identify the causes for impasse situations and generate suggestions to overcome them. Experiments with *NA*, evaluating the impact of e-mediation on negotiation behavior and outcomes, indicate positive effects: The number of agreements was higher and the negotiation outcomes were perceived as being fairer in the treatments with e-mediation [5, 6].

The basis of this study is that different support approaches produce different communication and concession patterns and consequently different outcomes of negotiations. Moreover, both support approaches have strengths and weaknesses: Analytic negotiation support attracts negotiators' attention to negotiation outcomes and maximization of individual utility it might increase competitive negotiation behavior and push negotiators – in highly conflicting negotiation cases – into impasses. On the other hand, mediation support focuses – per definition – on the facilitation of negotiation processes. By emphasizing behavioral flexibility only, subjects might not be able to identify Pareto-efficient moves and therefore settle for inefficient agreements. It, therefore, seems fruitful to integrate both support philosophies to answer the question, whether they interact well with each other.

3 Systems

The base system used in the experiments is *Negoisst* which is a web-based eNS that offers communication and analytic support as well as document management [60, 61]. According to Kersten's [13] classification, it is an active facilitative support system which does not provide advice to

negotiators. However, apart from analytic support, it also offers features to support communication quality.

In *Negoisst*, users communicate via electronic messages formulated in natural language (see Figure 1). *Negoisst* offers to its users semantic and pragmatic enrichment of their messages to avoid communication failures. The semantic enrichment feature links the text to the negotiation agenda and the pragmatic enrichment feature requires users to categorize their messages as offers, counter-offers, questions, and clarifications, which allows to distinguish between formal messages (offers and counter-offers) and informal messages (questions and clarifications). While offers and counter-offers are binding for the negotiation partners, the exchange of informal messages gives the parties the opportunities to discuss conflicting issues informally, i.e. "off the records". Everything which is written within informal messages is not binding.

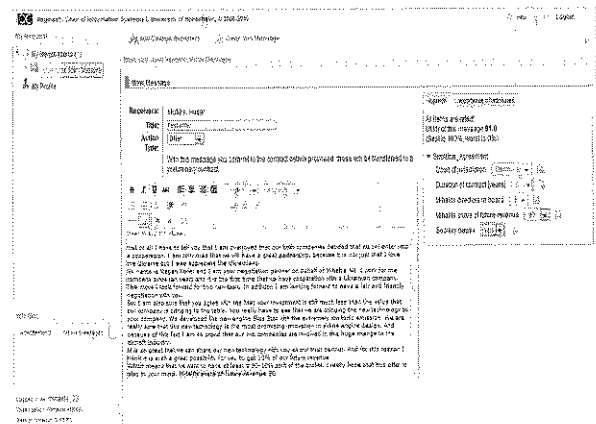


Figure 1: *Negoisst* Interface

An optional analytic decision support module of *Negoisst* allows the specification of negotiator preferences on attributes and the determination of utility functions for negotiators. These functions are used for the linkage of exchanged offers with distinct utility values based on negotiators' preferences.

In addition to *Negoisst*, we used *vienNA*, a system based on the e-mediation system *NA* [5]. *vienNA* carries out the tasks usually assigned to a human mediator in face-to-face negotiations [5] and comprises the following functions: (i) Diagnosis as a monitoring of the progress of the negotiation toward or away from an agreement, (ii) analysis of the causes of impasse, and (iii) advice to overcome impasses based on diagnosis and analysis. These three functions are not provided proactively by the system, but instead on request and with input of users. Therefore this system is classified according to Kersten [13] as an active facilitative system and not as a pro-active mediation system.

The aim of *vienNA* is to increase negotiators' flexibility and thereby the prospects of finding an agreement. It follows clearly a behavioral support approach.

The system gathers information on the parties' flexibility with regard to the issues under dispute and the negotiation process by means of a questionnaire (see Figure 2).

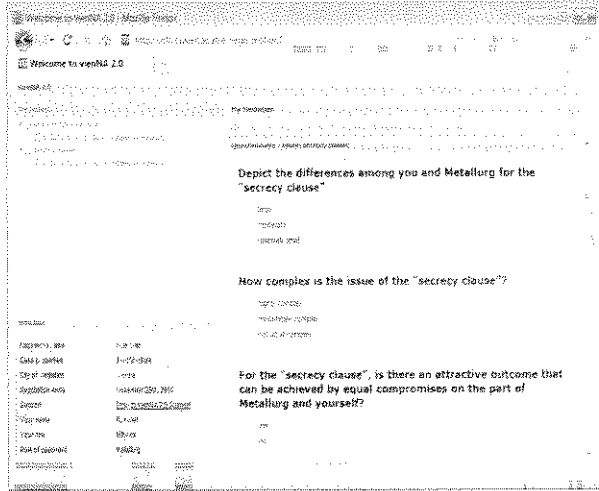


Figure 2: *vienNA* Questionnaire

A knowledge base, derived from a meta analysis of experiments on the factors that influence the negotiators' flexibility [4], is applied to evaluate the answers. The calculated flexibility score for each party is graphically represented in a grid as shown in Figure 3.

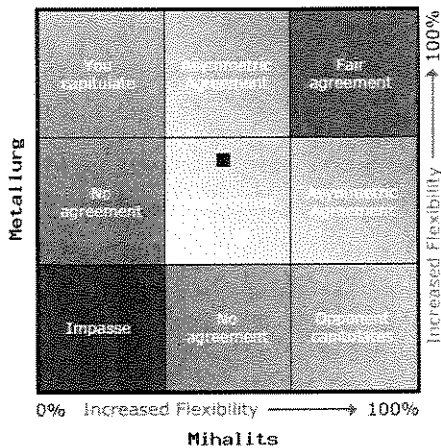


Figure 3: *vienNA* Flexibility Grid

Moreover, answers that indicate impasse situations are listed with a link to the corresponding advice on how to move toward agreement. The answers are saved in a database which allows the parties to answer the

questions independently. The mediation results are stored to provide a history of past mediations.

For the experiment the *vienNA* interface reproduced the interface of *Negoisst* which eases the transition between both systems and aims at increasing user acceptance. Subjects could access the e-mediation system via a direct link from *Negoisst* to *vienNA*.

4. Method

In November 2010, 224 undergraduate students of negotiation courses from four European universities participated in the laboratory experiments. A 2 x 2 experimental design was implemented by providing participants with the different support system described above (see Table 1).

In the first treatment, participants were provided with *Negoisst*'s analytic decision support (AS) and behavioral decision support (BS) of *vienNA*. In the second treatment participants had access to analytic decision support only. In the third treatment users had access to behavioral support of *vienNA* only. The control group (fourth treatment) had no access to either kind of decision support but only the basic communication support of *Negoisst*.

Subjects could consult *vienNA* at any time and as often as they wanted during the negotiation process. e-Mediation could be initiated by either party by choosing a mediation topic, i.e. "the most conflicting issue". Consecutive e-mediation rounds required both parties to complete the previous e-mediation round. However, to ensure that subjects in the *vienNA* treatments used the system, each dyad had to go through a diagnosis phase by *vienNA* at least once before completing negotiations.

Students received course credit for participation independent of their performance in the negotiations. Negotiation dyads were matched with students from different universities to insure that they did not know each other, and to avoid that they share information or communicate outside of systems. This matching procedure as well as no-shows resulted in varying treatment sizes.

Treatments	Analytic decision support (AS)	
	yes	no
Behavioral decision support (BS)	yes	n=66 n=50
	no	n=74 n=34

(n=number of participants)

Table 1: Experimental Design

Subjects represented two European companies from Ukraine and Austria in the aviation industry. The parties negotiated a bilateral joint venture. The case description consisted of general information about the joint venture project and private information containing predefined preferences for either party¹. The case was developed as a mixed-motive negotiation task. The subjects had to agree on seven issues, i.e. share of future revenue, a secrecy clause, the number of directors in board, duration of contract, court of jurisdiction, additional payment of Ukrainian workers, and payment of common workers. Two issues were particularly divisive: the “share of future revenue” and “duration of contract” were designed to have only a small zone of possible agreement (ZOPA) restricted by hard constraints which were indicated to the parties in their respective private information. The case description also indicated that there are alternatives to the current negotiations, so that parties did not have to settle at all costs.

Instructors of the negotiation courses at four European universities provided a briefing of the systems one week before the start of the negotiations. Furthermore, subjects received test accounts to practice all available functionalities of the systems. The case was sent to all subjects one day before the negotiations started. The first time subjects logged into the system they had to go through a quiz about the case in order to assure that they understood the most important aspects.

A pre-negotiation questionnaire was used to gather information about demographics of the participants and to control for the influence of language skills and familiarity with eNS. Negotiations lasted for two weeks; however, subjects could terminate negotiations at any time. After finishing the negotiations, subjects answered a post-negotiation questionnaire. The negotiation transcripts, exchanged offers as well as all the answers on the pre- and post-negotiation questionnaire were recorded by the system for analysis.

5. Results

In the following, we compare the two systems' effects on the following dependent variables: (i) Number of agreements, (ii) Individual and joint utility scores, and (iii) User satisfaction. In addition, we address the following questions: (iv) Who is initiating behavioral support in the negotiation? (v) Do subjects require more help with the negotiation process or with the issues?

In a first data screening procedure, negotiation dyads were eliminated in which participants violated

the experimental conditions. The remaining 206 participants formed 103 negotiation dyads.

Treatments	BS+AS	AS	BS	Control
# Agreement	17	21	12	11
# No Agreement	12	16	8	6
Agreement Rate	59%	57%	60%	65%

Table 2: Number of Agreements

Table 2 shows, that the highest agreement rate was reached by subjects in the control group, followed by those in the behavioral support (BS) group. The lowest agreement rate was reached by subjects supported with analytical decision support only. These numerical differences are, however, statistically not significant.

Treatments (dyad)	BS+AS	AS	BS	Control
Joint Utility	1.05	1.06	1.05	1.06
Contract Imbalance	0.10	0.10	0.12	0.11

Table 3: Utility and Concessions

The analysis of the quality of agreements is based on the measure of joint utility, i.e. the sum of individual utilities for the agreement, as a measure of outcome efficiency, and contract imbalance, i.e. the absolute difference between individual utilities of the agreement, as a measure of fairness – smaller values indicate fairer agreements. Table 3 shows the (non-significant) differences among the treatments in these two quality dimensions of outcome.

Additional regression analyses show, however, that the point of time of the mediation process (Time BS) as well as communication measures, i.e. number of formal and informal messages exchanged, have a significant impact on the joint utility (see Table 4).

Coefficients	B (SE)	b	Sig.	VIF
Time BS	-.006(.002)	-.468	.002	2.210
AS	-.018(.018)	-.168	.327	1.913
Time BS*AS	.009(.004)	.461	.022	2.524
Informal Messages (IM)	-.014(.005)	-.454	.004	1.533
Formal Messages (FM)	.005(.002)	.291	.043	1.307
IM*FM	-.003(.001)	-.373	.017	1.516
Intercept	1.074(.014)		.000	

Dependent Variable: Joint Utility; R2=28.1%, Adj.R2=19.1%, F-Ratio (3.130), F-Test (0.011), Durbin-Watson (2.072)

Table 4: Joint Utility Regression Analysis

¹ Case descriptions and preference information can be obtained from the authors

The results show, that the earlier subjects consulted *vienNA* (BS), the higher is the joint utility of the agreement reached (Time BS, $p < .01$). This effect was even stronger in the treatment in which both types of support were available (Time BS*AS, $p < .05$). The regression model also shows that the more often subjects exchanged messages informally (“off the records”) the lower the reached joint utility ($p < .01$). The opposite is true for the exchange formal messages: the more offers and counteroffers were exchanged, the higher the joint utility ($p < .05$).

The analysis of mediation consultation shows that, interestingly, the party which - according to the protocol - has to wait for the opponent to begin the negotiation is more often initiating an e-mediation consultation.

<i>vienNA</i> Issues	N	Party 1	Party 2	ZOPA
Share of future revenue	19	20%	20%	1%
Process Related	18	-	-	-
Secrecy Clause	9	10%	25%	50%
Directors in Board	5	20%	20%	20%
Duration of Contract	5	25%	5%	16.67%
Court of Jurisdiction	1	15%	20%	33.33%

Table 5: Issues mediated by *vienNA*

The analyses of conflicting issues which led to the *vienNA* consultation (behavioral decision support) are summarized in Table 5.

One of the two most conflicting issues – the one with the smallest ZOPA according to the case description – is also the one which *vienNA* users chose most frequently for e-mediation. Problems with the negotiation process were the second most e-mediated issue category. The third most frequent issue, i.e. the secrecy clause, was the most important issue for one of the negotiation roles, i.e. had the single highest weight (25 %) of all issues.

As a subjective evaluation criterion of negotiation outcomes user satisfaction was assessed on three dimensions: Satisfaction with outcome, process, and social aspects (relationship building & trust). A principal factor analysis of twelve post-questionnaire items (KMO 0.861, Explained Variance 71.09 %) confirms the three suggested factors: satisfaction with process (SATPRO), satisfaction with agreement (SATOUT), and satisfaction with relationship building & trust (SATSOC).

Loadings (>.4)	SATPRO	SATOUT	SATSOC
SATPRO1	.659		
SATPRO2	.616		
SATPRO3	.568		
SATPRO4	.523		
SATOUT1		.907	
SATOUT2		.898	
SATOUT3		.849	
SATOUT4		.771	
SATSOC1			.901
SATSOC2			.895
SATSOC3			.813
SATSOC4			.806
Cronbach Alpha (std.)	.775	.945	.927

Table 6: Pattern Matrix Satisfaction

Figure 4 shows that negotiators’ satisfaction with the negotiation outcome is higher for the treatments with behavioral support (BS) ($t_{(68)} = -1.390$, $p = .085$, 1-tailed). In contrast, analytic decision support (AS), as provided in the first two treatments, results in a higher satisfaction with the process compared to negotiators without this type of support ($t_{(48)} = -1.489$, $p = .078$, 1-tailed). Finally, users with neither decision support were most satisfied with the social aspects of the negotiation, i.e. with relationship building and trust ($t_{(17)} = 1.908$, $p = .073$, 2-tailed).

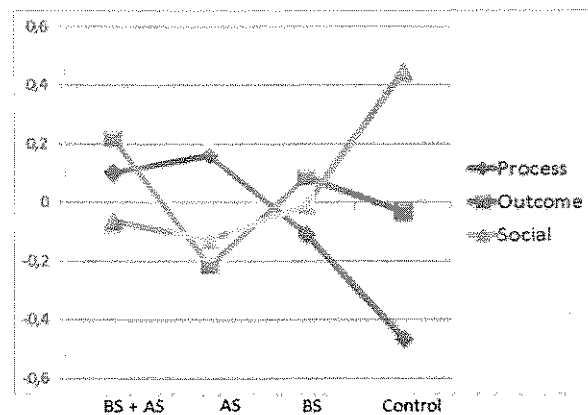


Figure 4: Satisfaction Measures

6. Discussion & Outlook

The basic assumption of this study is that different support approaches, manifested in the functionalities of systems, lead to different communication and concession patterns in negotiations. These differences in turn have significant effects on outcomes of negotiations. Previous research suggests that both support approaches, behavioral and analytic decision support, have strengths and weaknesses. In this research we aimed at combining their strengths and

integrated both support philosophies. We conducted a laboratory experiment to explore whether the distinct philosophies work well with each other or whether there are interaction effects between these support approaches that undermine their separate advantages.

The key findings of these experiments are:

(i) Although the objective outcome measures differ only marginally across treatments the subjective outcome measures show a different picture: The users report significant differences in their satisfaction with their own performance, their outcomes, the negotiation process and the social relationship they established to their counterpart, depending on the support they were provided with. Negotiators with behavioural support were most satisfied with negotiation outcomes. Negotiators with analytic decision support are the most satisfied with the negotiation process. This indicates that determination of the negotiation process by the analytic decision support system is well perceived by its users. Satisfaction with social aspects of the negotiation like relationship building and trust was perceived highest from subjects in the control group. It seems that this group which was completely undirected focused more on social aspects compared to all other treatments.

(ii) We found relative strong interaction effects between support approaches. The effectiveness of behavioural decision support is not only influenced by its timing in the process but also by the availability of additional analytic decision support. The most important finding here is that early consultation of behavioural support during negotiation processes has positive effects on outcome efficiency, even more so, when analytic support is available. Furthermore, the analysis of issues triggering the consultation of behavioural decision support reveals that the experienced degree of conflict is relevant for the decision to consult e-mediation services. Subjects most often consulted *vienna* with issues which had a very small ZOPA, with process related issues, or with issues with high issue weights for at least one party indicating its importance for the party. The positive effect of behavioural decision support on outcomes is also reflected in the higher satisfaction of subjects in the treatments with *vienna* with the negotiation outcome.

(iii) Finally, the expected positive effects of e-mediation on less tangible - socio-emotional - aspects of negotiations such as the establishment of a personal relationship and trust between negotiators have not been observed in the experiment.

Overall, this study has both, delivered some interesting and new insights into the effects of distinct support approaches, but at the same time has revealed a number of important questions. First of all, to deeply understand the processes of negotiation and mediation,

it requires more in-depth analyses to identify differences in the behavior of the negotiators supported by systems following different philosophies. Therefore, we plan to analyze the process by means of content analysis of negotiators' communication [28] and concession analysis [9]. In particular we are interested in comparing processes between early and late users of *vienna*, because the benefits of the behavioral support can only unfold if there is enough time after consultation.

Moreover, the specific influence of the different support features needs to be examined in more detail. Therefore, the perceived usefulness of specific system features of the behavioral and analytic decision support need to be analyzed.

Finally, the systems compared in this experiment are still classified as active facilitative systems in Kersten's system classification [16, 14]. In a next step, it is interesting to see whether proactive analytic and behavioral decision support can influence negotiation processes and outcomes in a beneficial way.

7. References

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APPENDIX

Measurement of subjective outcome measures (5-point Likert-scale)

Satisfaction with results

- SATOUT1: I am satisfied with the results I achieved
- SATOUT2: I am satisfied with the results as compared to my expectations
- SATOUT3: I am satisfied with the results when considering my initial objectives
- SATOUT4: I am satisfied with the results as being favorable for me

Satisfaction with process

- SATPROC1: I am satisfied with my performance in the negotiation
- SATPROC2: I was confident in engaging in my tasks
- SATPROC3: I was effective in accomplishing my tasks
- SATPROC4: I represented my client adequately

Satisfaction with social aspects

- SATSOC1: My counterpart listened to my concerns
- SATSOC2: A good foundation was set for a future relationship with my counterpart
- SATSOC3: My counterpart was sincere
- SATSOC4: I enjoyed working with my counterpart

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