

# **Negotiation Support Systems (NSS): A Cumulative Series of Laboratory Experiments**

William C. Perkins<sup>1)</sup>, Abbas Foroughi<sup>2)</sup>

<sup>1)</sup> Indiana University, Kelley School of Business

<sup>2)</sup> University of Southern Indiana, School of Business

## **Abstract**

This paper describes an ongoing series of laboratory experiments to investigate the efficacy of using a negotiation support system (NSS) to support one or both parties in a negotiation situation. An NSS is a special category of group support system (GSS) designed to support the activities of a negotiating group. According to Lim and Benbasat [1], the core components of an NSS include an individual decision support system (DSS) for each party in the negotiation and an electronic communication channel between the negotiating parties.

The present paper describes six studies conducted at Indiana University and Arizona State University, beginning in 1988 and continuing through the present. The primary research question asked by all of these studies is:

- What is the effect of an NSS on negotiation outcomes and negotiator attitudes?

Other research questions asked include:

- What is the effect of the individual NSS components (e.g., electronic communication, DSS) on negotiation outcomes and attitudes?
- Is NSS support equally effective in situations of high conflict of interest and in low conflict situations in which more trade-offs are possible?
- Is NSS support equally effective in a face-to-face negotiation setting, in negotiation via telephone, and in negotiation via computer conferencing?
- In negotiation via computer conferencing, does it make a difference whether both parties have a DSS, only one party, or neither party?

## **1. Introduction**

This paper describes an ongoing series of laboratory experiments to investigate the efficacy of using a negotiation support system (NSS) to support one or both parties in a negotiation situation. An NSS is a special category of group support system (GSS) designed to support the activities of a negotiating group. According to Lim and Benbasat [1], the core components of an NSS include an individual decision support system (DSS) for each party in the negotiation and an electronic communication channel between the negotiating parties.

The present paper briefly describes six studies conducted at Indiana University and Arizona State University, beginning in 1988 and continuing through the present. The primary research question asked by all of these studies is: What is the effect of an NSS on negotiation outcomes and negotiator attitudes? Other research questions consider the effect of the individual NSS components (e.g., electronic communication, DSS) on negotiation outcomes and attitudes; ask whether NSS support is equally effective in situations of high conflict of interest and low conflict of interest; and investigate whether NSS support is equally effective in a face-to-face negotiation setting, in negotiation via telephone, and in negotiation via computer conferencing.

All six studies in this series are laboratory experiments in which the subjects are playing the roles of buyer and seller in an industrial bargaining situation. As the reader will see, these studies clearly build upon one another to provide an increasingly comprehensive view of the efficacy of using a negotiation support system to support one or both parties in a negotiation situation. Five of the six studies – all but the fourth study – employ student subjects in the bargaining roles. These five studies were all carried in laboratories located on the campuses of Indiana University and Arizona State University. The remaining study employed purchasing managers as the industrial buyers and sellers in the simulated negotiation situation; this fourth study was carried out on the premises of the firms employing the purchasing managers, usually in a conference room setting.

## **2. First Study: Jones, 1988 [2]**

The initial study in this set was conducted by Beth Jones [2] as her Ph.D. dissertation at Indiana University. Jones conducted a laboratory study using student subjects in which modeling support was provided at one step in the negotiating process – after 12 minutes of face-to-face bargaining, contract suggestions which had been calculated by the computer were presented to the negotiators. To conduct this study, Jones created a manufacturing bargaining situation, a mixed-motive task, which has been used in all of the experiments in this series. The task involved negotiation of four issues (unit price, purchase quantity, time of first delivery, and warranty period) of a three-year purchase agreement for an engine subcomponent. She created high and low conflict of interest conditions by varying the weights assigned to the four issues. Low conflict treatments were simulated by assigning different weights for the four issues, creating a bargaining situation in which mutually beneficial trade-offs were possible. High conflict treatments featured issues for both parties being weighted similarly, creating a zero-sum situation in which one party's gain was equal to the other one's losses. For both low and high conflict levels, point sheets were constructed for buyer and seller using these weights. The case material included an "alternative contract," representing a contract offer by another company, which provided the subjects with a minimum point level to achieve in the negotiations.

The point of the Jones study was to compare the performance of subjects who received the computer suggestions to subjects who did not receive the suggestions. The results indicated that the computer suggestions led to higher joint outcomes in low conflict, but required greater negotiation time. In terms of negotiator attitudes, the high conflict dyads (pairs) perceived a greater level of collaborative climate with computer support.

## **3. Second Study: Foroughi, Jelassi, and Perkins, 1995 [3]**

The second study in this set, co-authored by Abbas Foroughi, M. Tawfik Jelassi, and William C. Perkins, appeared in *Group Decision and Negotiation* in 1995 [3]. This study used Jones' task – again with student subjects – but provided a full-featured NSS that provided computer support throughout the negotiation session. Two kinds of software tools were used. First, Topic Commenter, a module from the GroupSystems GSS, served as a means of electronic communication between the bargainers to be used for inputting their comments and proposals, displaying them on a public screen, and allowing viewing of each other's inputs on their private screens. The second type of software was a customized decision support system called the Negotiation Decision Support Tool (NDST), the DSS developed for this study to support alternative generation and evaluation.

In the NSS treatments, negotiators each had personal computers connected via a local area network to each other and to a public display screen and file server to be able to use Topic Commenter. Negotiators were instructed to communicate with their bargaining opponent only via Topic Commenter. Each negotiator also had a stand-alone PC to run the NDST. Negotiators were seated across from each other and had a clear view of each other and the display. In the non-NSS treatments, exactly the same procedures were used but with no computers present. The negotiators communicated orally, and they wrote their suggested contract proposals on a blackboard. In summary, data were collected for four cells (2 x 2 design): NSS, low conflict; NSS, high conflict; no NSS, low conflict; and no NSS, high conflict.

The results of this study indicated that NSS support did help bargainers achieve significantly higher joint outcomes and more balanced contracts in both high and low conflict situations, but that NSS support significantly increased negotiation time. In terms of negotiator attitudes, satisfaction was greater for NSS dyads in both high and low conflict, and perceived negative climate was reduced for NSS dyads in low conflict.

## **4. Third Study: Delaney, Foroughi, and Perkins, 1997 [4]**

The third study in the series, co-authored by Michael M. Delaney, Abbas Foroughi, and William C. Perkins, appeared in *Decision Support Systems* in 1997 [4]. This study investigated the impact of using the decision support system (NDST) alone as compared to the combination of the NDST and electronic communication.

In this study, the data from the second study [3] were used and data from two additional cells were collected – high and low conflict with each party having access to the NDST only. In summary, data from six cells (2 x 3 design) were available: full NSS, low conflict; full NSS, high conflict; DSS only, low conflict; DSS only, high conflict; no NSS, low conflict; and no NSS, high conflict. The key result from this study was that the DSS, not the electronic communication, was the critical component of the full-featured NSS that permitted higher joint outcomes. There were no significant differences in negotiator attitudes between the DSS-only dyads and the no NSS dyads. In terms of

negotiation outcomes, results with the DSS only were very similar to the results with the full NSS except for a higher number of contracts proposed in those cells with the DSS only.

## 5. Fourth Study: Perkins, Hershauer, Foroughi, and Delaney, 1996 [5]

The fourth study, co-authored by William C. Perkins, James C. Hershauer, Abbas Foroughi, and Michael M. Delaney, appeared in the *International Journal of Purchasing and Materials Management* in 1996 [5]. This study was a partial replication of the second and third studies with an important difference: The subjects were **purchasing managers**. Data for only four cells were collected for this study (2 x 2 design): DSS only, low conflict; DSS only, high conflict; no NSS, low conflict; and no NSS, high conflict.

The sample size of this study was much smaller than studies two and three, so there were fewer statistically significant results. Nevertheless, the direction of the results was consistent with the results found with student subjects. In both high and low conflict situations, managers with computer support had higher joint outcomes and better contract balance than those without computer support. Furthermore, managers with computer support made fewer offers and took less negotiation time than those without computer support. Again, as with the student subjects in study three, there were no significant differences in negotiator attitudes between the DSS-only dyads and the no NSS dyads. The conclusion of study four is that students and managers appear to have the same bargaining behavior, except that managers take less time to negotiate when they have the aid of a computer while students take more time. There are several possible explanations for this difference in negotiation time, but the authors favor two interrelated arguments: (1) the familiarity of the purchasing managers with the bargaining process, and (2) the tendency of the managers to accept a satisfactory solution rather than continue negotiating toward a more nearly optimal one.

## 6. Fifth Study: Foroughi, Perkins, and Jessup, in review [6]

The fifth study, by Abbas Foroughi, William C. Perkins, and Leonard M. Jessup [6], is still in the review process. In this study, **no** face-to-face bargaining took place; all bargaining took place either by telephone or by computer conferencing. Subjects were students, and both parties in all bargaining dyads had the use of the decision support system (NDST). The design was a 2 x 2, with data collected for four cells: audio-conferencing, low conflict; audio-conferencing, high conflict; computer conferencing, low conflict; and computer conferencing, high conflict.

The study result that stands out is that joint outcome was higher with the telephone (audio-conferencing) in high conflict. Otherwise, it did not make any difference whether negotiations were conducted by computer conferencing or by telephone in terms of joint outcome and contract balance. As expected, negotiation time was greater with computer conferencing than with audio-conferencing. However, subjects' attitude measures were more favorable to audio-conferencing in the low conflict situation. In summary, audio-conferencing did enhance negotiation results and did not negatively impact attitudes in high conflict. In low conflict, there were no differences in terms of negotiation results but the bargainers using audio-conferencing experienced higher perceived collaborative climate, higher satisfaction, and lower perceived negative climate than bargainers using computer conferencing. When there is little conflict, it appears as though computer conferencing (e.g., the mechanics of using the system and the impersonality of communicating via the computer) just got in the way, while the audio-conferencing let the bargainers get the job done quickly and easily. In high conflict, the efficiency aspects of audio-conferencing – a richer medium in which more communication can take place more quickly (people can speak faster than they can type) – overshadowed any negative social cues transmitted over the telephone, and the result was an improved joint outcome, using less negotiation time, with audio-conferencing, and no significant differences in the attitude measures. To phrase these conclusions in another way, *efficiency matters* to the bargainers! They were able to achieve outcomes that were just as good or better with audio-conferencing, with less bargaining time, and thus their attitudes towards audio-conferencing were either no different or more favorable than with computer conferencing.

## 7. Sixth Study: Perkins, Hershauer, and Foroughi, in preparation [7]

The paper for the sixth and final study (William C. Perkins, James C. Hershauer, and Abbas Foroughi) [7] is still in preparation. This study used student subjects with **computer conferencing** for all negotiations, using an application called WebBoard to negotiate over the Internet. There were eight cells in this study, half with high conflict and half with low conflict. For two cells, both parties in the bargaining dyad had the use of the decision support system (NDST); for another two cells, only the seller had the use of the NDST; for two more cells, only the buyer had the use of the NDST; and for the last two cells, neither party had use of the NDST.

The preliminary results of this study indicate that giving both buyer and seller the NDST appears to provide a significant advantage in both joint outcome and contract balance, especially in low conflict; there may also be an advantage to giving either the buyer or the seller the use of the NDST in terms of these two outcome measures. Analysis of the attitude measures has not been completed.

## 8. Conclusions

We view this set of six studies (five of them co-authored by the authors of this paper) as a major success, but really only the beginning of a comprehensive program of research to investigate the efficacy of negotiation support systems. For the most part, the use of an NSS – either a full-featured NSS or the DSS only – improved bargaining performance in terms of joint outcomes and contract balance. Student took more time to achieve these improved results, but managers actually took less time when they had the use of a decision support system. In terms of the attitude measures, the results were quite mixed. The implication for NSS research is that more controlled research in real-life negotiation settings is needed in which the behavior of actual negotiators – with and without an NSS – can be studied. Negotiation support systems have a great deal of promise, but more research and development is needed to achieve this promise.

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