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THE IMPACT OF INFORMATION AND COMPUTER BASED TRAINING ON NEGOTIATORS' PERFORMANCE

ABSTRACT. This paper presents the results of an experiment on negotiation, designed to measure the impact of (1) computerized training and (2) information on negotiators' performance

The paper is structured as follows. First, we review the literature on negotiation training. Second, we develop a conceptual framework to link various forms of Negotiation Support Systems to joint and individual negotiation performance. Third, we present the negotiation paradigm – a bilateral monopoly – and the computerized training system we used. Regarding training, our results show an asymmetric impact on individual performance levels and, unexpectedly, a negative impact on negotiators' joint performance. In contrast, more information improves both individual and joint performance. Finally, we discuss these results, and outline further research questions.

Keywords: Negotiation, Training, Computer.

1. INTRODUCTION

Across a wide variety of situations, it seems evident that training improves one's performance. Conceptual models (e.g., Bass and Vaughan 1966), press reports (e.g., Sellers 1988), the proliferation of training programs (according to Baldwin and Ford 1988, American firms spend in excess of $100 billions a year to train their employees) and common sense all support this notion. Current research on training focuses on design issues such as how should training relate to the specific characteristics of the task and the trainees, what factors improve transfer of learned behaviors to the workplace, how do we measure the effectiveness of training, and how much does performance increase due to training (Goldstein 1980, Wexley 1984).

Computerized systems offer a promising alternative to more traditional training methods. Computer Based Training Systems (CBTS) can provide tutorials adapted to the specific needs of the trainee, with diagnosis and feedback mechanisms, and can be easily adapted to simulate the relevant work environment (Dede 1986, Sleeman 1984).

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In many situations, CBTS's have been shown to be at least as effective as conventional training methods and generally more economical (Dossett and Hulvershorn 1982, Wexley 1984).

More recently, the domain of application for CBTS's has been extended beyond well defined areas such as algebra, into more subtle problems. In the area of negotiation, CBTS's are but one of the several avenues currently explored to capitalize on the possibilities offered by computer based technologies: (A) Negotiation Expert-Systems (NES) assemble a knowledge base relative to a specific class of negotiation problem (e.g., Rangaswamy *et al.*, 1989); (B) Negotiation Information Management Systems (NIMS) are being conceived to facilitate negotiation in real time (e.g., Kersten 1987, Nyhart and Goeltner 1987); (C) Computer Based Training Systems (CBTS) are designed to expose negotiators to typical problems in order to improve their skills (e.g., Clopton 1986).

This work on various forms of Negotiation Support Systems (NSS) is still at a very early stage of completion and little is known about the actual impact of NSS's on performance. This paper examines how the quality of information provided by NIMS's and the negotiation skills learned through CBTS's affect both individual and joint performance. The remainder of the paper is structured as follows. First, we review published evidence on the impact that training has on performance in the context of two-party negotiations. Then, we distinguish between two concepts of negotiation performance – joint and individual – and link them to various forms of NSS's in a parsimonious conceptual framework. We finally present our methodology and experimental results before discussing areas where further research is needed.

2. TRAINING AND NEGOTIATION PERFORMANCE

2.1. What Do We Know about the Impact of Training on Negotiators' Performance?

While negotiation training – computerized or not – is gaining attention (Lewicki 1986, Weitz *et al.* 1986) our knowledge concerning the impact of training in the setting of two party negotiation is quite limited. Some of the work has focussed on the more general impact that learning has on negotiation. For instance, Walker (1971) studied the impact of learning on negotiators' performance, and had his subjects go through 4 rounds of negotiation in a situation based upon earlier work by Siegel and Fouraker (1960). He reported statistically insignificant performance increases in some instances, and (cautiously) concludes that the "study suggests that the negotiation process does tend to become more efficient and routine as bargainers learn the economic parameters of the situation and their partner's accommodation levels . . ." (p. 198).

Walker's work raises two questions. First, 'learning' is assumed to be the implicit consequence of repeated negotiations. However, there is no guarantee that gaining familiarity induces learning (Alba and Hutchinson 1987): faster – and more efficient – settlements in later rounds can result from changes in expectations, from the increased visibility of a likely settlement point or from boredom, rather than from the discovery of a better negotiation process. If familiarity translates only partly into learning, and repetition favors the status quo, then Walker's results may well understate the true impact that learning has on negotiation performance.

On the other hand, Walker uses an incomplete information negotiation paradigm, in which repetition changes the very nature of the game. Each new round gives more information on the payoff structure of the adverse party. As a result, differences in performance could be attributed to differences in the information structure of subsequent rounds of the game itself, rather than to improved abilities of the negotiators.

This interpretation allows us to reconcile Walker's findings with those of Bognanno and Dworkin (1978). Using a similar paradigm, but this time in a complete information and non repeated setting, the authors report that the majority of settlements are Pareto efficient.[1] Interestingly, they were studying Cross' (1969) theory that learning *decreases* negotiators' individual performance. According to Cross' framework, better learners concede more rapidly than less able learners in the course of a negotiation round, when they are in the presence of a conceding opponent. Bognanno and Dworkin conclude that "the spread [in individual performances] may be explained by the existence of [a] differential learning parameter" (p. 37). Unfortunately, they do not indicate whether that difference is statistically significant, nor do they suggest why sellers learn better and achieve lower payoffs than do buyers.

Bazerman and Neale (1982) try to isolate the net impact of training on negotiating performance in the context of a non-repeated negotiation environment. They report that "... training, even in its most rudimentary form, is an effective means of improving the human decision-making process" (p. 546). However, the labor negotiation paradigm they use is such that the performance measure is the rate of concession made by the negotiators, with a more modest objective and a higher concession rate taken as indicators of superior negotiating effectiveness (since the costs of a strike are so high). While their results might be interpreted as showing that training increases joint performance, it is not clear how the trainees' individual performance was affected by their concession strategy. In fact, most empirical evidence suggests that the best individual strategy, is a "tough but fair" approach (Chertkoff and Esser 1976, Harnett *et al.* 1973).

In addition to the question of the performance measure, Bazerman and Neale's manipulation is closer to 'framing' than training (see Rapoport *et al.* 1977 for a discussion of the experimental problem): the trained subjects were told that negotiators overestimate the probability that their final offer will be accepted. Although learning about perceptual biases is an important objective for training programs, the end result is to give the trained subjects *more and better* information on the situation, rather than to train on *how to use* that information. Whether the performance increase is a consequence of a modified aspiration level, of better information (e.g. this offer has a 45% chance of being accepted, versus the 60% chance I thought earlier) or superior negotiation ability (e.g. our workers will get a better deal if I propose a lower offer rather than if I stick close to my initial demands and go on strike) is unclear.

Finally, Clopton (1986) discusses the benefits of computerized negotiation training for industrial buyers, and indicates that buyers like computerized training systems. However, his work did not report the result of training in subsequent negotiations, nor does he report performance results. Still, he concludes that the "... microcomputer [is] a useful tool for training buyers in negotiations" (p. 85).

In short, the limited direct evidence suggest that the merits of negotiation training are grounded in results obtained from other areas. These results include those showing a positive link between training, learning, ability and performance (see Pearlman *et al.* 1980, Newell and Rosenbloom 1981, Schmidt *et al.* 1982); conjectures based on econometric evidence that, at the aggregate level, negotiations become more efficient over time (Hundley and Koreisha 1987); and considerable evidence on the value of information in negotiation (Chatterjee and Lilien 1984, Eliashberg *et al.* 1986, Hamner and Harnett 1975).

2.2. What is Negotiation Performance?

Our review of previous experimental work provides us with two concepts of short run negotiation performance: a joint (or integrative) performance criterion where one is concerned with the sum of the gains realized by all the parties to the trade, and an individual (or distributive) performance criterion, without regard to what the other party achieves.

Since negotiations involve both creating and sharing wealth, the lines between efficiency (creating the most total wealth) and effectiveness (getting the best personal deal) are blurred: a negotiator may succeed because of his ability to realize a 'fair' share of efficient trades, while another may be equally successful by squeezing a disproportionate fraction out of inefficient trades. From the perspective of a training program whose objective is to make an individual negotiator successful, integrative and distributive routes to personal gain are equally valuable, although the ways of effecting those routes are likely to be quite different. The impact of training on joint and individual performance are different questions and must be addressed as such. The remainder of this section presents a conceptual model to link NSS components to negotiation performance (Exhibit 1).

2.3. Training, Performance and the Mediating Effect of Knowledge

The literature in cognitive science distinguishes between cognitive *structure* and *processes* (Anderson 1984, Calfee 1986, Hesse 1982). Cognitive structure refers to the beliefs an individual entertains on the state of the world (the facts) while the term cognitive processes refers

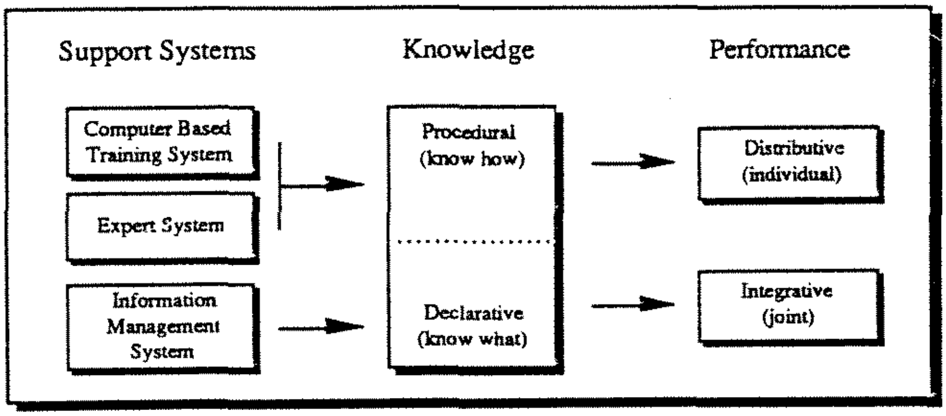


Exhibit 1. Support systems, knowledge and negotiation performance.

to the decision rules applied to this representation (how to use the facts). This framework carries over to our paradigm: cognitive structures holds the information relevant to the game (knowledge of the payoffs to the parties involved and of the rules of engagement), and the cognitive processes generate and select strategies (knowledge of the appropriate sequence of moves to be used given the information).

Consider the following examples. Trading currencies on money markets is a rather simple task: potential currency sellers ask for a price and potential buyers bid prices. If, somewhere in the market, there is a positive spread between bid and ask, the currency trader trades. The critical knowledge variable here is raw information – a precise and comprehensive cognitive structure – usually supported by terminal screens and phone lines that clutter every currency trader's office. In this type of trade, a novice with on-line bids and asks has an edge over an experienced practitioner using, perhaps, the Wall Street Journal as sole source of information. Experience is not a critical variable here. Learning the "art of negotiation" is less important than having access to vital information without delays. The impact of negotiation training for novice traders would be dwarfed by the impact of an information management system.

In contrast, selling turnkey steel plants to foreign countries demands a thorough understanding of the trading process. While raw data is valuable, the difficulty in effecting a trade lies more in knowing what data are relevant to the trade and how the discussion should progress – a rich and detailed set of cognitive processes – rather than in the precision and timeliness of the basic data itself. Here an inexperienced negotiator loaded with data is at a disadvantage when compared with an experienced negotiator with limited data. In this situation, a good mastery of the art of negotiation is crucial. The expert negotiator has an edge because he knows more about negotiation, but he may also have a reasonable idea of what the missing pieces of information must be (e.g. "Our plant in Brazil was completed in 22 months and we can expect something similar here.") while the novice negotiator may not even know how to take advantage of his own data.

We make three observations here. First, two different forms of knowledge are important in a negotiation: the *declarative knowledge* (know what) pertaining to the object and participants to a trade, and the *procedural knowledge* (know how) pertaining to the process of negotiating.

Second, procedural knowledge usually carries some level of declarative knowledge along with it (Simon and Chase 1979). If procedural knowledge has been acquired through experience, the negotiator has probably been exposed to a range of payoffs and negotiating partners.

Finally, this knowledge dichotomy suggests that several different types of negotiation support systems might be appropriate, some primarily targeted at the declarative knowledge (NIMS) and others at the procedural knowledge (CBTS and NES). Consider the impact of expert systems vs training systems. Both attempt to improve performance by improving the set of decision rules available to a negotiator, using different approaches: expert systems give access to expert knowledge, while training systems increase the negotiator's personal knowledge base. Information systems, on the other hand, attempt to improve performance by giving access to more and better information. Our experiment isolates the relative impact of a CBTS designed to improve performance via better procedural knowledge, from the impact of a NIMS designed to improve performance via better declarative knowledge.

2.4. Statistical Model and Hypotheses

Our basic hypothesis is that NSS's have a positive impact on individual and joint performance. CBTS's are expected to increase individual performance (Clopton 1986). They should also contribute to reduce negotiation inefficiencies via a learning effect (Walker 1971). NIMS's should contribute to improve joint performance because they facilitate the identification of Pareto optimal strategies. They should also improve individual performance when they give access to privately held information (Hammer and Harnett 1975). To be able to identify the source of performance increase in individual's performance we use two measures of performance: the fraction of the benefits realized by a negotiator and the total benefits he realized. All effects on one party are partialled for the level of training and information provided to the other party. More formally:

H1: Information has a positive impact on the negotiators' own share of the benefits
H2: Information has a positive impact on negotiators' own benefits
H3: Information has a positive impact on joint benefits
H4: Training has a positive impact on the negotiators' own share of the benefits
H5: Training has a positive impact on negotiators' own benefits
H6: Training has a positive impact on joint benefits

The framework presented in Exhibit 1 is cast in the following statistical model, taking into account both types of effects and discriminating between buyer-specific and seller-specific impacts.

$$\text{Individual performance} = \alpha + \beta_1 \text{ Seller training} + \beta_2 \text{ Buyer training} + \beta_3 \text{ Seller information} + \beta_4 \text{ Buyer information} + \varepsilon \qquad (1)$$

$$\text{Joint performance} = \alpha + \beta_1 \text{ Seller training} + \beta_2 \text{ Buyer training} + \beta_3 \text{ Seller information} + \beta_4 \text{ Buyer information} + \varepsilon \qquad (2)$$

$$\text{Share of benefits} = \alpha + \beta_1 \text{ Seller training} + \beta_2 \text{ Buyer training} + \beta_3 \text{ Seller information} + \beta_4 \text{ Buyer information} + \varepsilon \qquad (3)$$

Equations 2 and 3 have been estimated at the dyad level, while equation 1 has been estimated separately for buyers and sellers. OLS was used for all estimations.

3. METHODOLOGY

3.1. *Negotiation Paradigm*

The bilateral monopoly game developed by Siegel and Fouraker (1960) has been widely used in experimental settings because it provides enough complexity to make the negotiation a non trivial exercise, yet is simple enough to be easy to communicate to experimental subjects. This game, in spite of its simplicity, involves a very subtle strategic problem.

This paradigm has a monopolist faced with a marginally increasing cost function selling a commodity to a monopsonist faced with a marginally decreasing revenue function. The situation is depicted in Exhibit 2. The problem of maximizing joint gains has a simple solution: produce a quantity Q^* that will maximize the difference between total revenues and total costs.

In the Fouraker–Siegel scenario however, the integrative problem conflicts with the distributive one. While the quantity traded uniquely determines the size of the pie to be divided between the buyer and the seller, the price determines the size of the slice awarded to each party. A careful examination of the payoff structure shows that the seller has an incentive to set the price such that he will obtain more than half of the joint profits, and that the buyer has an incentive to purchase less than the Pareto optimal quantity.

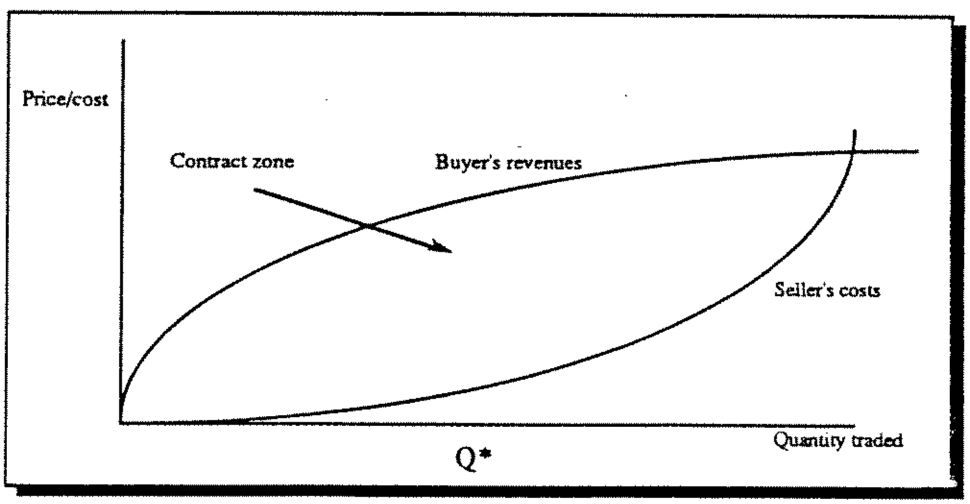


Exhibit 2. A bilateral monopoly: revenues, costs and contract zone.

		Price						
Seller		$10	$11	$12	$13	$14	$15	$16
Quantity	8	29.33	37.33	45.33	53.33	61.33	69.33	77.33
	9	31.29	40.29	49.29	58.29	67.29	76.29	85.29
	10	32.80	42.80	52.80	62.80	72.80	82.80	92.80
	11	33.87	44.87	55.87	66.87	77.87**	88.87	99.87
	12	34.45	46.45	58.45	70.45	82.45	94.45	106.45
	13	34.55	47.55	60.55	73.55	86.55	99.55	112.55
	14	34.12	48.12	62.12	76.12	90.12	104.12	118.12
	15	33.15	48.15	63.15*	78.15	93.15	108.15	123.15
	16	31.62	47.62	63.62	79.62	95.62	111.62	127.62
	17	29.51	46.51	63.51	80.51	97.51	114.51	131.51
Buyer								
Quantity	8	69.73	61.73	53.73	45.73	37.73	29.73	21.73
	9	75.08	66.08	57.08	48.08	39.08	30.08	21.08
	10	79.76	69.76	59.76	49.76	39.76	29.76	19.76
	11	83.78	72.78	61.78	50.78	38.78**	28.78	17.78
	12	87.17	75.17	63.17	51.17	39.17	27.17	15.17
	13	89.94	76.94	63.94	50.94	37.94	24.94	11.94
	14	92.12	78.12	64.12	50.12	36.12	22.12	8.12
	15	93.73	78.73	63.73*	48.73	33.73	18.73	3.73
	16	94.78	78.78	62.78	46.78	30.78	14.78	−1.22
	17	95.29	78.29	61.29	44.29	27.29	10.29	−6.71

* Nash Bargaining solution
** von Stackelberg solution

These tables present the payoffs to the seller and buyer for a certain range of prices and quantities (the tables used in the experiment covered the interval {1 . . 20} in price and {0 . . 20} in quantity). For example, if the seller charges $12 and the buyer orders 15 units, the seller realizes a profit of $63.15 and the buyer realizes $63.73. The Nash (1950, 1953) bargaining solution is indicated by one asterisk. This strategy is Pareto efficient and splits the profits equally. The Nash solution is unstable: the buyer has an incentive to buy 14 units. The von Stackelberg solution[3] is indicated by two asterisks. This solution is an equilibrium but not Pareto efficient.

Exhibit 3. Payoff tables.

Suppose that the price can be any integer in the interval {1 . . 20} and that the quantity can be any integer in the interval {0 . . 20}. Relevant fragments of payoff tables are presented in Exhibit 3. With complete information, both parties can readily see that a quantity of 15 units is Pareto optimal and yields a joint profit of $126.88, irrespective of the price set by the seller. What should this price be?

The seller could think for himself that both parties should share the profits equally, and set the price accordingly at $12. This corresponds to the Nash (1950, 1953) bargaining solution, where Pareto optimal profits are shared equally. Note however that this solution is not an equilibrium: when the seller quotes $12, the optimal order quantity from the buyer's perspective is 14 units (payoff to $64.12), not 15 (payoff of $63.73). Should the seller open the negotiations at a price of $12?

We examine two possibilities. First, the seller could presume that the buyer will myopically maximize his payoffs at any quoted price. If the seller quotes $12, a myopic buyer will order 14 units. The seller should therefore adopt a von Stackelberg strategy, where he computes at what quantity the buyer maximizes his own profits for every price the seller could possibly quote. For example, if the seller quotes $11, the myoptic buyer will order 16 units giving a payoff to the seller of $47.62; if he quotes $13, the myopic buyer will order 12 units giving a profit to the seller of $70.45. Following this reasoning through will indicate that the optimal price quotation from the vantage point of the seller is $14. At that price, the buyer maximizes his profit when he buys 11 units, yielding $77.87 to the seller, $14.72 more than at the Nash bargaining solution. The new position represents a loss of $9.23 in terms of joint performance. However, the seller has no incentive to do otherwise and should open the negotiation with a price of $14.

On the other hand, nothing guarantees that the buyer will act myopically. A non-myopic buyer could reason that the only acceptable solution is an equal split of the Pareto optimal profits: he may never buy a quantity that will give more than the Nash profits to the seller. Thus, if the seller quotes $14, the buyer will shade his true payoff function and limit his purchase to 8 units. The buyer realizes a benefit of $37.73, slightly less than his myopic optimum, but in doing so he gives only $61.33 to the seller. If the seller quotes $13, the buyer will purchase 10 units, etc. In this situation, the seller has no incentive to deviate from the Nash bargaining solution and should open the negotiation with a quoted price of $12. These two strategies are examples of sensible solutions that rational negotiators could develop.

The purpose of our training system was to help the subjects discover these subtleties, and allow them to understand how to initiate and respond to maneuvering by an opponent in the direction of a given bargaining solution.

3.2. The Task

Subjects were instructed that the negotiation would cover a 52-week period. The seller started by quoting his price, any integer value in the interval {1 . . 20}. Then the buyer ordered a quantity for the current week, any integer value in the interval {0 . . 20}. The same procedure was repeated for each 'week.' The content of communications was limited to price quotes and quantity orders. Subjects were instructed to maximize their *individual* payoffs.

3.3. Design and Manipulations

Subjects were randomly assigned to following eight (2^3) conditions (see Exhibits 6 and 7 for more details): (Seller or Buyer) × (Trained or Untrained) × (Complete information or Incomplete information). Subjects were not aware of the treatment condition of their negotiation partner.

To manipulate the information condition, all subjects were given 4 different payoff tables that might have been used by their partner. Subjects in the complete information situation were told exactly which payoff function was used by their partner, while subjects in incomplete information situation were not. Providing complete information is akin to having a perfect NIMS. All subjects knew which payoff function applied to themselves.

To manipulate the training condition, we have developed a CBTS to introduce the negotiation problem and allow trainees to negotiate against a variety of pre-programmed algorithms. The training system reproduced the experimental conditions: the negotiations covered 52 periods; the system could play either the buyer or the seller; give complete information or not regarding the system's payoff function; use any of four pre-programmed strategies for either the buyer or the seller. These strategies were developed along the lines of economic analysis – myopic and non-myopic strategies – and behavioral observations – hard, soft and adaptive strategies (Raiffa 1982, Perdue *et al.* 1986). Screen samples are presented in Exhibit 4.

Subjects in the training condition were handed the training software and required to go through a minimum of four complete negotiations with the CBTS, prior to the actual negotiation. At the beginning of the training session, the CBTS described the Fouraker–Siegel paradigm

Screen 1: Set-up screen

Initializing Negotiations

What position do you want to play? **You play SELLER COMPLETE***
What payoff function do you want to use? **You use payoff function 2**
What strategy would you like me to use?

1. Myopic response
2. Shaded response
3. Hard response
4. Adaptive response
5. Confidential

Awaiting reply
>>>_

* The portions in bold resulted in previous answers to the system's prompts.

Screen 2: Negotiation screen

Fouraker & Siegel

			Seller's profit		Buyer's profit	
Week	Price	Quantity	Period	To date	Period	To date
1	$20	1	$14.900	$14.900	$0.900	$0.900
2	$17	2	$23.596	$38.496	$5.710	$6.610
3	$12	5	$32.398	$70.894	$25.116	$31.726

You play SELLER with payoff function #2
My strategy is MYOPIC RESPONSE. I use payoff function #1

What price do you quote?
>>>_

Exhibit 4. Computerized training system: two sample screens.

and presented all 8 strategies. For each strategy, a short description was provided, and advice given concerning its use. After each negotiation, the training system computed a performance index (ratio between actual score and efficient 50–50 split) for the subject as well as for the machine-based strategy, and asked for comments. All quotes, scores and comments were archived on the training disk which was returned to the experimenter once the training session was over.

Our computerized seller could play: (1) Hard, (2) Fair, (3) Myopic, (4) Adaptive. The Hard strategy consists of quoting, without deviating, the price of the von Stackelberg solution described in Section 3.1; the Fair strategy quotes the price of the Nash (50–50 split) bargaining solution. Trained subjects were informed that these strategies were reasonable when the seller has complete information, and that the Hard strategy was less likely to work when the buyer also has complete information.

The Myopic strategy consists of a search along the price line. The seller tries various prices until he is satisfied that he has found the price that maximizes his payoff. Trainees' instructions indicated that such a strategy may be appropriate whenever the seller has incomplete information, and warned that the seller could be tricked, particularly in cases where the buyer has complete information. The fourth strategy was designed explicitly to deal with this latter case. The Adaptive strategy is myopic, until a settlement appears imminent, but then assumes that the buyer misrepresents his true payoff function. The computerized seller therefore increases its quoted price by $2 over the myopic optimum. The instructions to trainees warned that this strategy has a high likelihood of being perceived as very aggressive and could lead to rounds of retaliatory actions.

As the buyer, the system could play: (1) Hard, (2) Myopic, (3) Shaded, and (4) Adaptive strategies. The Hard strategy consists of buying nothing unless the price goes at least as low as the Nash solution price. The comments about this strategy state that it sends clear signals and tends to be efficient when both parties have complete information. The Myopic strategy consists of buying the quantity that maximizes the buyers' payoff, given the price quoted by the seller. Trainees were informed that this strategy can be used in situations of incomplete information, but that in cases where the seller has complete information, the buyer could be exploited and likely to be forced into a von Stackelberg solution.

The Shaded strategy mimics the myopic strategy in that it gives the impression that the buyer is maximizing its payoff given the current price quote, while in fact, the quantities ordered lie on a line leading to the Nash solution. The instructions to the trainees state that this strategy might be appropriate when the buyer has complete information and when the seller has incomplete information, although the signals sent by the buyer could be understood even when the seller is fully informed. Finally the Adaptive strategy mirrors the sellers' adaptive strategy, except here quantity is lowered by two units after a myopic optimum is found.

3.4. *Measurements*

The three dependent variables are obtained directly from the payoff tables used by the subjects. The non-discounted average of their profits over the 52-week period was used to compute the negotiators' score (individual performance). Joint performance is the sum of individual performances at the dyad level. The share is computed as the fraction of the proceeds going to the seller. Two independent dichotomous variables are used to characterize each individual: Training (=1 if trained and 0 otherwise); Information (=1 if complete information and 0 otherwise).

3.5. *Subjects*

All subjects were graduate students registered in negotiation classes. Their participation was mandatory and they were told that their performance would be graded on the basis of their *own* payoff. One hundred and two subjects completed the negotiation experiment.

4. EXPERIMENTAL RESULTS

Statistical results are presented in Exhibit 5. All four equations are significant (first and higher order interactions were tested and found to be non-significant).

	Score[1]			
	a-Seller	b-Buyer	c-Joint	d-Share[2]
Intercept	57.5	52.7	110.23	0.528
1. Seller trained	−0.7	−12.5**	−13.2*	0.065*
2. Buyer trained	−3.6	2.8	−0.7	−0.027
3. Seller informed	12.9**	−0.2	12.7*	0.049
4. Buyer informed	−9.7*	4.3	−5.4	−0.075*
R^2	0.21	0.19	0.19	0.22
F	3.0*	2.8*	2.6*	3.2*
N	51	51	51	51

[1] The performance score averages the proceeds over the 52-week negotiation period
[2] Share of the benefits appropriated by the seller
* indicates significance at 0.05 level or less
** indicates significance at 0.01 level or less

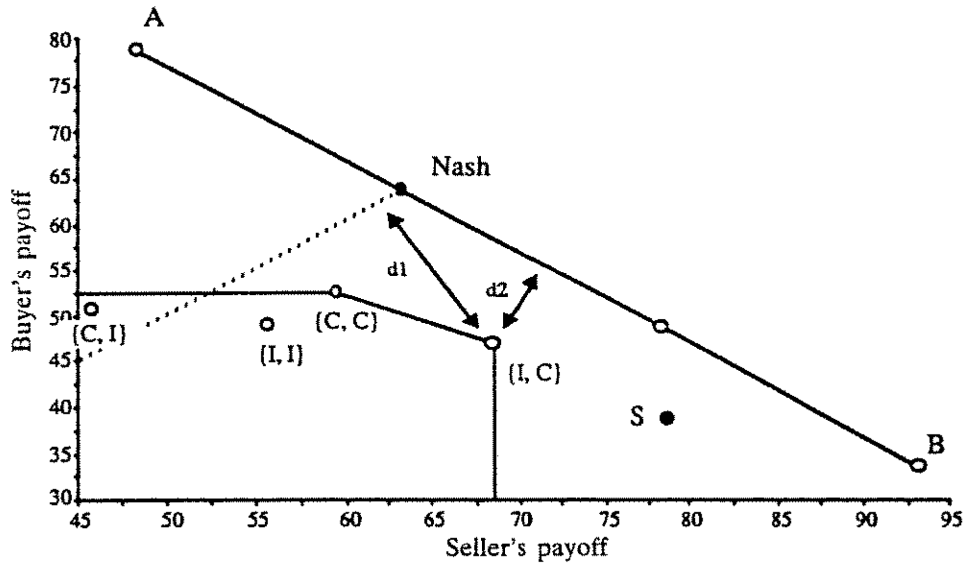
Exhibit 5. OLS estimates of training and information impact on performance.

The impact of information is generally positive. H1 receives partial support: informed buyers are able to secure a significantly larger share[2] (4d) of the profits in comparison with uninformed buyers. While information has no significant effect on sellers' profits share, it contributes nonetheless to a significant increase of their profits (3a) as a result of more efficient settlements (3c), as hypothesized in H2 and H3.

H4 receives partial support. The impact of training on negotiator's profit share is positive and significant in the case of the seller (1d), albeit non significant in the case of the buyer (2d). Yet this effect does not contribute to a real performance improvement. When we consider actual payoffs, trained sellers do not perform better than untrained ones (1a). The share gain is not the reflection of an increase in sellers' performance, but is rather a consequence of a significant *decrease* in buyers' performance (1b). H5 is therefore rejected. And overall, the impact of training on joint performance is significantly negative (1c) – H6 is also rejected.

Exhibits 6 and 7 allow us to get a better understanding of our experimental results. Exhibit 6 shows the net impact of information while controlling for training, and Exhibit 7 shows the net impact of the training manipulation while controlling for information. These exhibits present the average results of all pairs sharing the same treatment. Dominant pairs are joined to create a convex payoff region. Results are labeled {C, I} to indicate a Complete information buyer paired with an Incomplete information seller, etc. The distance between a treatment result and the line segment A–B measures the loss in efficiency: a perfectly efficient negotiation result would lie on the segment A–B. The distance between a treatment result and the dotted line going through through the Nash bargaining solution indicates deviation from the fair share rule (50–50 split). Points lying above this dotted diagonal indicate a buyer advantage; points below this dotted diagonal indicate a seller advantage.

From Exhibit 7, we see that the value of information matters mostly for the seller, for whom information asymmetries are an important factor in his negotiating performance. In this game, if he possesses an information advantage over the buyer, the negotiation will be relatively efficient, and he gets a generous fraction of the proceeds. If the buyer has the information advantage, the negotiation tends to be



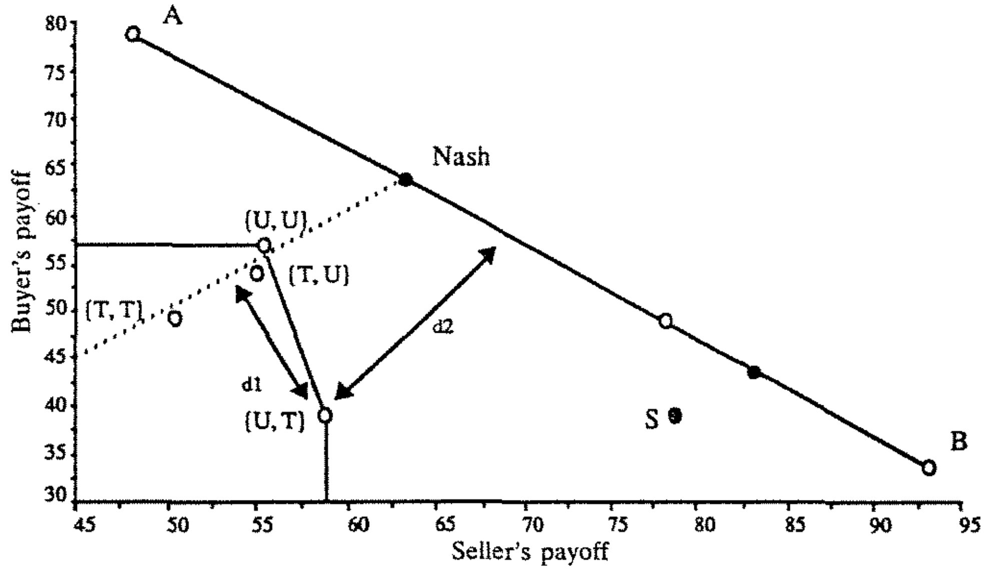
The line segment A–B represents the Pareto frontier for a negotiation using the payoff tables of Exhibit 3. For example, point A indicates a contract at P = \$13 and Q = 15, yielding \$78.15 to the seller and \$48.73 to the buyer, etc. The point labeled Nash is the Nash bargaining solution, while S represents the von Stackelberg solution.

The experimental treatments are indicated in brackets. For example, the average contract between buyers with incomplete information and sellers with complete information {I, C} gave \$68 per period to the seller and \$47 per period to the buyer (the impact of training has been partialled out). The efficiency loss is represented by the distance between the point {I, C} and its projection on A–B (d2), and the asymmetry of the result in favor of the seller is represented by the distance to its projection on the 'fair' share line (d1).

Treatment	Treatment Payoff Means		Number of Dyads
	Buyer	Seller	
Buyer Complete – Seller Complete	53	59	6
Buyer Incomplete – Seller Complete	47	68	6
Buyer Complete – Seller Incomplete	51	45	6
Buyer Incomplete – Seller Incomplete	49	56	33

Exhibit 6. The impact of information when training is kept constant.

inefficient and the seller can no longer extract more than a 'fair' share of the deal. Note that in symmetric positions (both complete or both incomplete, and where the impact of training has been partialled out) the results are reasonably efficient and represent 'fair' deals. The slight advantage to the seller in both cases is attributable to the exploitation by von Stackelberg strategies.



The line segment A–B represents the Pareto frontier for a negotiation using the payoff tables of Exhibit 3. For example, point A indicates a contract at P = \$13 and Q = 15, yielding \$78.15 to the seller and \$48.73 to the buyer, etc. The point labeled Nash is the Nash bargaining solution, while S represents the von Stackelberg solution.

The experimental treatments are indicated in brackets. For example, the average contract between untrained buyers and trained sellers {U, T} gave \$39 per period to the buyers and \$59 per period to the sellers. The impact of information has been partialled out. The efficiency loss is represented by the distance between the point {U, T} and its projection on A–B (d2), and the asymmetry of the result in favor of the seller is represented by the distance to its projection on the 'fair' share line (d1).

	Treatment Payoff Means		
Treatment	Buyer	Seller	Number of Dyads
Buyer Trained – Seller Trained	48	51	8
Buyer Untrained – Seller Trained	39	59	16
Buyer Trained – Seller Untrained	55	56	18
Buyer Untrained – Seller Untrained	57	56	9

Exhibit 7. The impact of training when information is kept constant.

While information matters to the seller, training matters to the buyer. But, what seems to matter most to the buyer is not his own training, but whether or not the seller is trained. Exhibit 7 shows how pairs with symmetric training line up remarkably well on the 'fair' share line. However, the interesting result here is not that equal training leads to equivalent payoffs, but rather that untrained pairs are *more* efficient than trained pairs.

The results obtained by asymmetric pairs shed some light on this unexpected situation: while the buyer is unable to extract more than a fair (50%) share of the trade even when he faces an untrained seller, the seller is able to impose a major shift in the payoff sharing when he faces an untrained buyer. However, this shift is accompanied by a large loss in efficiency. Apparently, many buyers realize that they are being taken advantage of and the negotiation is protracted: untrained buyers do not seem capable of handling the situation properly. They give in (reluctantly) while trained buyers send signals strong enough to discourage exploitative sellers.

To summarize, complete information improves negotiators' joint performance, while training diminishes it. Information benefits mostly to the seller, and training sellers has a strong negative impact on buyers' expected profits.

5. DISCUSSION

5.1. A Few Additional Remarks on Our Results

As seems to be the case in most such experiments, subjects that were exposed to training generally enjoyed the experience. Following the negotiation exercise (but before the scores were divulged) subjects were asked if they thought that training would have an impact on their negotiation performance: none felt they performed worse because of the training. Most stated that they felt they performed better as a result of the training (an unwarranted impression as we showed above). Indeed training mattered, at least for the buyers. In this case, however, the statistically significant result occurred for the opponent's training, and reduced the total expected payoffs from the trade.

It is somewhat disquieting to observe that we have not been able to 'teach' effective negotiation strategies for a problem at the low end of strategic sophistication. While this could be the consequence of a poorly designed training program, it is interesting to note that this result is similar to those obtained in the repeated Prisoner's Dilemma paradigm (see Rapoport *et al.* 1976 for a substantial review of the literature on this topic). The Prisoners' Dilemma game sees a high proportion of novices outperforming experienced negotiators. Novices tend to cooperate, either from the outset, or after only a few repetitions, while 'expert' negotiators are more likely to use the less trusting equilibrium strategy (i.e., defect) resulting in efficient outcomes.

Being knowledgeable about a variety of competitive strategies and even their uses might not be nearly enough to ensure better performance. The 'art' of negotiation – real expertise – comes when one knows how to blend knowledge of the situation, knowledge of the opponent and strategic knowledge according to the demands of the situation, how to produce "tough but fair" behavior that is the key to good performance. It is possible that our negotiation training might have shifted the focus to a competitive approach, while the situation we had (a repeated game) favored a cooperative approach. It is also conceivable that our trained negotiators were entertaining unrealistic expectations about their performance, making the negotiation process more difficult.

These observations, that framing and expectation levels are critical factors in determining the negotiators' performance and are likely to be modified by training, raise numerous related questions on the need for more comprehensive systems and the need to model the dynamics of training effects.

In the same vein, our results should not be construed to mean that training has little or even a negative impact on performance, once we take into account the availability of information. Our paradigm was highly stylized, leaving little room for strategic creativity and with a trivially simple information structure. In problems of greater complexity, training might help negotiators, partly because it will help them absorb and make sense of a larger fraction of the information available to them. Yet this effect is still in some sense an information effect, where information availability means whether the negotiator can (or cannot) use some information. But again, in the context of a negotiation problem, this is a speculative statement for which there is no hard evidence in the literature, and the difficulties we experienced in training for strategic behavior in a simple environment should provide some indication of the magnitude of the problem one will face in complex environments.

5.2. Lessons for Training Design

This research leads us to make the following observations regarding negotiation training design. First, feedback during the course of a negotiation round is an important feature of such systems. Our experience showed that trainees had problems detecting whether they faced a soft or a hard opponent, a very important skill in negotiation. They also appeared unable to lay out and consistently adhere to a specific strategy, thus sending mixed signals that confused their opponent: in both cases, feedback or evaluation mechanisms should improve the training system effectiveness.

Secondly, negotiation training must reach a certain level of sophistication if it is to be useful. While exposure to basic concepts is a computerized system's forte, facilitating the development of truly strategic behavior from the trainee might require personal interactions, or the development of a much more complex machine-based system than the one we tested.

Third, our results provide empirical evidence on the importance of measuring the nature of the information available as well as the experience, training or formal teaching provided to the negotiators. They also indicate that information management systems and training systems address different dimensions of the negotiation process, with different results on performance expectations. We would expect that in strategically simple but informationally complex environments, information management systems should have precedence over training systems, and that in informationally simple but strategically complex environments the reverse should be true. If our capability for producing training systems were comparable to that of our producing information management systems, we would see much value in developing training systems for complex environments. That capability does not yet exist, however, and needs to be developed.

5.3. Future Research

Our work raised numerous issues for consideration. For negotiating agents, it is important to understand the strategic learning process better. Since training programs are often carried out concurrently with regular work, the problem of a potential efficiency loss for those with some level of expertise is not trivial. Considerations under which increasing expertise may lead to a decrease in performance should be identified, and appropriate correctives should be designed to alleviate the problem. In particular, we need to study the effect of subjects' framing (cooperative or competitive mode) and of the match between the training system and the trainee's expertise in relation with the nature of the complexity of the negotiation problem.

We should also address the basic difference between computer and human based tutorials: rapid technological changes in machine system capabilities have made it imperative to study this area further. The value of intensive versus long-term training programs should be investigated; it is possible that intensive machine based sessions combined with more traditional human lectures, evaluations and debriefing sessions might be more effective than either one alone.

On net, our research has raised more questions than it has answered, but it has, at least, indicated that the answer to the question of whether training improves negotiator's performance is not a trivial 'yes' and might in some instances be counter-intuitive. Researching training impact places us in front of a paradox: simple negotiation environments are easy to control and manipulate. They are so simple, in fact, that training might have little use. On the other hand, complex negotiation environments, where training is hypothetically useful, are difficult to operationalize and require much more sophisticated measurements and methodologies.

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NOTES

[1] A result is Pareto efficient when joint gains cannot be increased.

[2] Effects are referenced by row and column: −0.075 (4c) is on the 4th row and cth column of Exhibit 5.

[3] This is a shorthand for 'Nash equilibrium in a Stackelberg game'.

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