The Effects of Multimedia Communication on Web-Based Negotiation

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Abstract

With the rapid growth of electronic commerce, there is growing demand for remote online negotiations. Although the Internet now enables audio and video communication, most Web-based negotiation systems are still text-based. There is, however, a lack of research on the effects of multimedia on remote negotiations. In this paper, we present a theoretical model to investigate the impacts of multimedia communication in an online negotiation setting. The constructs in our model include communication efficiency, communication effectiveness, and positive and negative social-emotional communication. Through a simulated house purchasing negotiation experiment, we study how different multimedia combinations (text only; text with audio; text with audio and video) affect our constructs and thus further influence negotiation results. Our results showed that both text with audio and text with audio and video

communication were significantly preferred to text alone. However, the addition of video to text and audio communication in a negotiation environment was not found to be beneficial. It did not significantly improve communication efficiency, effectiveness or positive social-emotional communication, but distracted negotiators from focusing on the negotiation task. Our analysis also revealed that the communication efficiency construct did not correlate with the perceived success of the negotiation solution; however communication effectiveness and social-emotional communication did correlate with negotiation satisfaction.

Keywords: Multimedia communication, Web-based negotiation, communication efficiency, communication effectiveness, social-emotional communication

1. Introduction

The rapid growth of the Internet, and the World Wide Web in particular, has created a great opportunity for conducting business activities electronically. However, negotiation is typically not allowed or facilitated in online transaction processing. As electronic commerce matures and becomes more sophisticated, it will become necessary to negotiate complex, mutually determined deals or contracts electronically. The demand for negotiation also comes from the need for dispute resolution. As more and more companies move their business to the Internet, disputes may also increase significantly in this environment. For instance, at eBay, over 30,000 disputes between sellers and bidders were mediated by SquareTrade, an online mediation service in 2000 (Katsh and Rifkin 2001). In e-business, commercial complaints may involve billing, order fulfillment, breaches of contract, content disputes, privacy violations and other issues. Today, government agencies, consumer groups and industry associations are demanding that e-businesses provide online dispute resolution services to ensure that consumers have a quick and affordable way to resolve their complaints. The Federal Trade Commission is also promoting

online mediation services, as lawsuits or arbitrations in court are too expensive and impractical to resolve online disputes (Dennehy 2000). Due to convenience and cost savings, even traditional arbitration services are moving online (Thompson 2000).

Recognizing the market demand and potential, there has been a recent growth in the number of online resolution services, such as *Internet Neutral*, *NovaForum*, *Online Resolution*, *Square Trade*, *All Settle*, and *SmartSettle*. These services rely on the use of general purpose or specifically designed e-mails, chat rooms, instant messages, or video-conferences. It is unclear how these electronic communication channels are capable of supporting negotiation and mediation efficiently and effectively. As pointed out by Kersten and Noronha (1999a): "the explosive growth in electronic commerce has not reduced the complexity of negotiations conducted over the web, partly due to human factors, and partly because the underlying economic models remain unchanged, despite the increase in speed, reach, and computational efficiency."

In this paper, we present a theoretical model to investigate the impact of multimedia communication in an online negotiation environment. Constructs used in our model include communication efficiency, communication effectiveness, positive and negative social-emotional communication. Through a simulated house purchasing negotiation experiment, the constructs of our model are examined for multimedia influences and negotiation solution impacts. Three combinations of multimedia (text only; text with audio; text with audio and video) are used for comparison. Conclusions are drawn and areas for future research are suggested.

2. Current Research on Negotiation Support Systems

As a branch of Group Decision Support Systems (Fjermestad and Hiltz, 1999), many Negotiation Support Systems (NSS) have been developed to support negotiation. Such systems can be

classified as process support, decision support, and agent-based NSS. The objective of **process support NNS** is to facilitate a structured negotiation process through electronic media. In the past, computer-aided process support was limited to a decision room setting (Anson and Jelassi 1990). However, the Internet and web technology has provided a great opportunity for remote negotiation among businesses and consumers anytime and anywhere. It also raises security, privacy, and legal issues (Ford and Baum 1997) that have not been properly addressed in the NSS literature (Yuan et al. 1998).

The objective of **decision support NSS** is to help negotiating parties reach a better solution. It can be used to help negotiators in preparing for negotiation, assessing their own and the opposite party's positions and preferences, and suggesting better alternative solutions (Kersten and Noronha 1999a). The utility approach is the most common method to assess negotiators' preferences. This is a simple approach that requires little effort, but has all the negative results inherent to distributive negotiations (Kersten, and Noronha 1999b). In addition to analytical methods, artificial intelligence approaches such as case-based reasoning have been suggested to support conflict resolution (Sycara 1993).

Recently, **agent-based NSS** have attracted strong interest, especially among computer scientists. The main focus of this approach is on automated negotiation. Multiple intelligent software agents are created to negotiate with each other autonomously in an environment governed by rules. Two major barriers to automated negotiation are the need for ontology and the need for strategy (Beam and Segev 1998). There are also many other business and technical issues (Sandholm and Lesser 1995). Negotiation agents are still in their infancy, and currently, most negotiation agents are deigned for overly simplified applications. Software agent literature on negotiations also shows some misconceptions about the nature of negotiation (Kersten and

Noronha 1999b). An infrastructure is needed in which negotiators, DSS, and software agents work together for value creation in the negotiation process (Lo and Kersten 1999).

Although there are many studies that have examined negotiation and negotiation support systems, the focus tends to be on decision support or automation rather than processes support. Since negotiation involves a significant amount of communication, reasoning, arguing, and persuasion, its success often relies on applying a variety of negotiation strategies and tactics. However, very few experiments have been conducted in the "difficult", and more realistic, task areas of planning, negotiation, and conflict (Fjermestad and Hiltz 1999). Additionally, most experimental studies in this area have focused on group decision making, where subjects interact in same time/same place decision rooms via group decision support software (Fjermestad and Hiltz 1999). This setting is rather limited and unrealistic for typical negotiation tasks, that are more likely to occur in fully distributed (asynchronous) or mixed-mode conditions, especially in the electronic commerce environment. The Internet is a media-rich environment that provides great opportunities for negotiators to interact with one another in a distributed, synchronous or asynchronous manner. Earlier experiments should be replicated within this environment to reassess their effectiveness (Fjermestad and Hiltz 1999). To best utilize the Internet for this context, it is also important to understand how different multimedia combinations affect negotiation in this online setting.

3. Research Model and Hypotheses

The purpose of our research is to examine how different combinations of communication channels in a web-based negotiation environment may impact constructs of communication

efficiency, effectiveness, and socio-emotional communication. We also seek to examine how these constructs ultimately influence the negotiator's perception of the negotiation result.

Media richness theory (Daft and Lengel 1986) suggests that communication media may have different degrees of richness. Media with relatively more capacity are considered rich (such as video), while those with less capacity are regarded as lean (such as text). Rich media allows for the simultaneous exchange of more types of information, thereby facilitating clarity and reducing message ambiguity. Information-rich media is especially important and effective in cases where reaching a consensus is more difficult (Hollingshead et al. 1993). Media richness theory proposes that leaner media will be less effective for performing ambiguous tasks, but will be more effective for tasks requiring uncertainty reduction such as making a formal agreement. However, Kinney and Dennis (1994) found that using richer media did not improve performance for more equivocal task over less equivocal task.

Different media may also impact social-emotional communication. Social presence is the extent to which one feels the presence of a person with whom one is interacting. Social presence theory indicates that, compared to face-to-face communication, the fewer non-verbal cues in computer mediated communication will lead to a lower social presence (Short et al. 1976). In face-to-face communication, non-verbal cues such as eye contact, gesture and posture can regulate speaker turn-taking and even aid in relationship formulation (Short et al. 1976; Acker and Levitt 1987; Argyle 1988). Asynchrony in computer mediated communication systems and typing requirements may slowdown the exchange of social-emotional messages thus reducing both positive and negative social-emotional communication (Hiltz et al., 1986; Rice and Love 1987). Grounding theory also suggests that the more information communication channels that are available, the easier it is to "ground" or establish mutual understanding (Clark and Schaefer

1989; Clark and Brennan 1991). Social information processing (SIP) theory suggests that given sufficient time and message exchanges for interpersonal impression formation and relational development to accrue, relational communication in later stages of computer-mediated communication and face-to-face communication will be the same (Walther 1995).

In general, we may expect that richer media will result in better performance. Empirical tests however, did not provide strong support for this assumption. Tasks which primarily involve information exchange or simple problem solving have generally not shown benefits of video over audio-only communication technologies (Anderson et al. 2000). However, tasks involving bargaining and negotiations have been reported to show such benefits (Short et al. 1976; Williams 1997; Whittaker 1995). McGrath and Hollingshead (1993) suggested that user performance is affected not only by the richness of the media used, but also by the fitness between the media and the task. They hypothesized that if a task utilizes richer media than is required, the media may act as a "distraction". Alternately, if a task utilizes leaner media than is required, the media may act as a "constraint". These communication distractions or constraints are likely to negatively affect task performance. In their Task-Media Fit hypothesis table (McGrath and Hollingshead 1993), the task of negotiating conflicts of interest was best fit with face-to-face communication. This was followed by video systems (marginal fit), audio systems (poor fit) and text-based computer systems (poorest fit).

In this research, we focus on negotiation tasks and compare different combinations of media, rather than comparing media in isolation. Since it is often economically infeasible for negotiation parties involved in e-commerce to meet face-to-face, we only compare possible alternatives in the setting of web-based negotiation. In particular, we consider three online communication options: text only (T), text plus audio (TA), and text plus audio and video

(TAV). Our research model is presented in Figure 1. Through our empirical study, we wish to examine the effects of media combinations on our four constructs (communication efficiency, communication effectiveness, positive social-emotional communication and negative social-emotional communication). Additionally, we seek to examine the potential influences of these constructs on the perceived success of the negotiation solution.

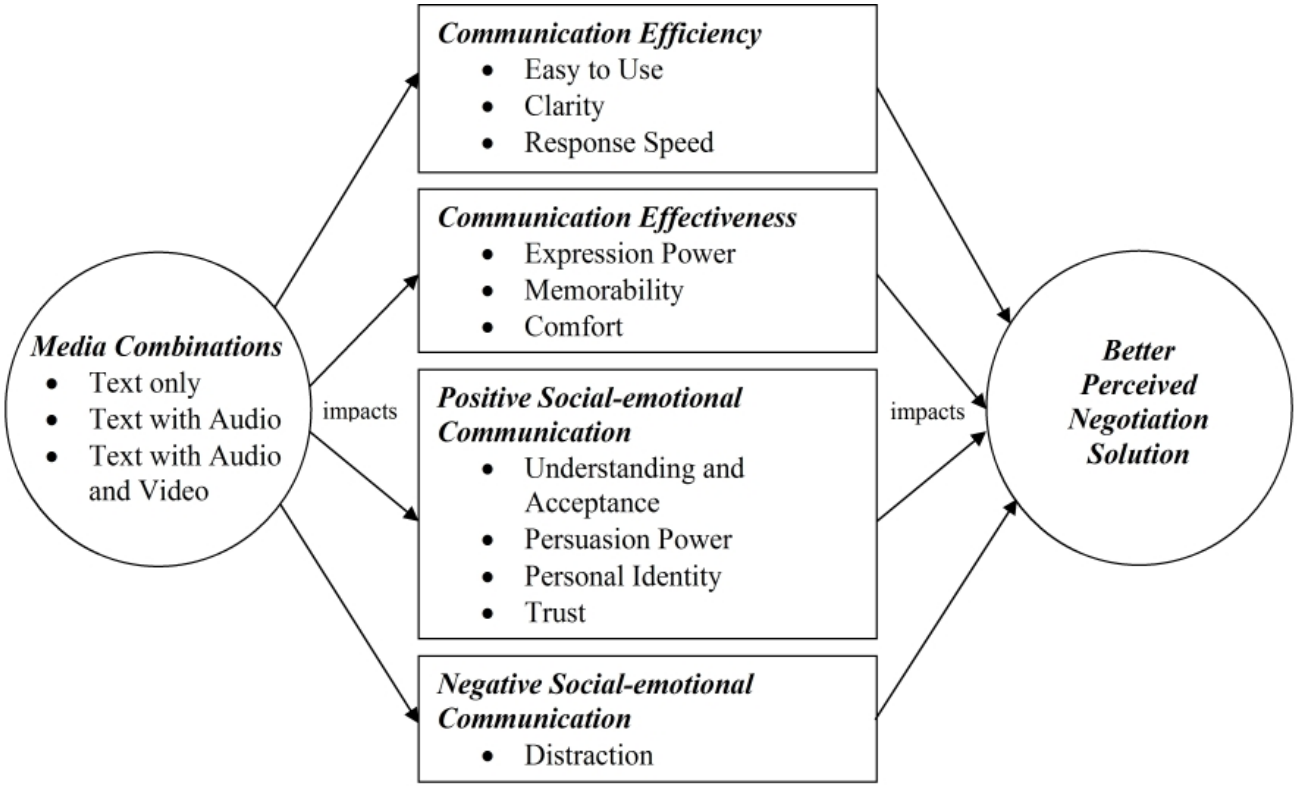

***Figure 1*: A Research Model for Media Effects in an Online Negotiation Environment**

3.1. Communication efficiency

We investigate the communication efficiency construct along three items: easy of use, clarity, and response speed. Easy of use refers to the degree to which a person believes that using a particular system would be free of effort (Davis 1989), which will have a direct impact on the

satisfaction experienced with the system (Trevino and Webster 1992). Different media require different degrees of effort and people may feel more comfortable using one type of media over another. For example, communication through a text channel requires keyboarding skills, mouse clicking, screen scrolling, and a certain level of literacy in reading and writing. Voice is a more natural form of communication, that has advantages of universality, operation over distance, and allowance for other modalities (Streeter 1988). However, using a voice communication channel over the Internet requires the use of a headset in order to improve audio quality and avoid echo effects. Video most closely matches face-to-face communication, however web cameras are difficult to position so that parties can have direct eye contact with each other.

Information clarity refers to the accuracy of information exchange. Negotiators' inaccurate perceptions of the other party often lead to cognitive biases and, subsequently, sub-optimal negotiation outcomes (Bazerman and Carroll 1987). The facilitation of information exchange between negotiators can significantly reduce these judgment errors (Thompson, 2000). Different media have different effects on the clarity of information exchange. Text is typically a very clear form of communication, however, precise wording is essential to avoid misunderstandings. Voice communication may be good for explanations, but may not be heard clearly. Image clarity of video over the Internet is still rather poor with existing technology and communication bandwidth. Additionally, both audio and video are transitory mediums, where it is difficult to review or preview information. However, when combined with text communication, this negative effect is somewhat mitigated.

Response speed is also critical for information exchange and interaction in negotiations. Audio and video enable immediate response and feedback, but response speed of typing is much slower and asynchronous. Morris et al. (2002) found that, compared to face-to-face negotiations,

people who negotiated via email were frustrated with their repeated inability to ask for information and receive immediate responses. Olson et al. (1995) found that groups communicating with simultaneous video and audio channels spent less time stating and clarifying issues when compared to groups communicating with audio only.

Based on the above literature and discussion, the following hypotheses are proposed for communication efficiency:

H1a: Communication efficiency will be greater for TA than T

H1b: Communication efficiency will be greater for TAV than T

H1c: Communication efficiency will be greater for TAV than TA

3.2. Communication effectiveness

We investigate the communication effectiveness construct along three items: expression power, memorability, and comfort. Expression power is related to media richness, but is not necessary the same. It largely depends on the task being performed. For instance, numbers, mathematical formulas, addresses maybe better represented through text. Conversely, verbal explanations may be better than written explanations for complex or multifaceted concepts. Voice or video may express people's feelings much accurately than text. However, voice may hinder communication if any of the parties do not speak the common language fluently.

Memorability refers to how easily people can remember the information being exchanged. Text is the easiest media to scan and review. However, complementary cues (such as audio added to text) can increase retention and improve understanding through a more vivid presentation that provides more potential links with existing information in long-term memory (Lim et al, 2000). Nugent (1982) and Baggett & Ehrenfeucht (1986) found that a dual modality output presentation tended to give subjects better comprehension and retention than single

modality outputs. Similarly, Sipior and Garrity (1992) found that presentations with a mix of audio and visual channels improved receptiveness attributes such as perception, attention, comprehension, and retention. Archer et al. (1996) also found that combining text and voice can aid in learning and remembering information.

The comfort of using particular media for negotiation is very important. Although most people prefer talking over writing, under certain circumstances writing may be preferred. For example, people may be more comfortable bearing bad news or unfavorable information via text, where wording can be more carefully chosen.

Based on the above literature and discussion, the following hypotheses are proposed for communication effectiveness:

H2a: Perceptions of communication effectiveness will be greater for TA than T.

H2b: Perceptions of communication effectiveness will be greater for TAV than T.

H2c: Perceptions of communication effectiveness will be greater for TAV than TA.

3.3. Social-emotional communication

Social-emotional communication may have positive or negative effects. We investigate the positive social-emotional communication construct along four main items: mutual understanding and acceptance; persuasion power, personal identity and trust. The negative social-emotional communication construct centers on the distraction of focus from the negotiation task.

Rapport development is critical for initiating communication, and may facilitate tension reduction, mutual trust and understanding. The absence of social cues (e.g. facial expressions, gestures, voice tones, etc.) in online text communication may reduce the opportunity for negotiators to engage in traditional offline politeness rituals (Morris et al. 2002). Dubrovsky et al. (1991) found that people are eight times more likely to flame in electronic discussion than in

face-to-face discussion. On the other hand, the same remoteness also can allow cooler heads to prevail. When negotiators are unable to develop a rapport with each other, it is more difficult to reach a mutually agreeable and beneficial solution (Morris et al. 2002). Internet enabled conferencing tools, such as Microsoft's NetMeeting, may enable online rapport development through instant messaging, voice and video communication.

Mutual trust is an essential quality in social relations (Mühlfelder et al. 1999). Nadler (2001) stressed that facilitating acceptance of on-line dispute resolution decisions is more difficult than in a traditional face-to-face environment because of the absence of cues that communicate trustworthiness. Fortune and Brodt (2000) found that negotiators interacting electronically were more likely to mistrust and suspect the other party of lying or otherwise deceiving them, relative to negotiators interacting face-to-face. In reality, e-negotiators were no more likely than face-to-face negotiators to deceive the other party.

Multimedia may negatively affect social-emotional communication by increasing distractions. A video channel can distract people from the focal task (Festinger and Maccoby 1964) and reduce task participation (Yoo and Alavi, 2001). Alternatively, lean media may steer users away from irrelevant interpersonal interactions towards focusing more on the problem (Phillips and Santoro, 1989). Although these interpersonal interactions may not be directly related to goal achievement, they may serve to build necessary rapport.

Based on the above literature and discussion, the following hypotheses are proposed for social-emotional communication:

H3a: Both positive and negative social-emotional communication will be greater for TA than T.

H3b: Both positive and negative social-emotional communication will be greater for TAV than T.

H3c: Both positive and negative social-emotional communication will be greater for TAV than TA.

3.4. Impacts on the Negotiation Solution

In addition to examining the effects of media combinations on various communication constructs, we wish to understand how media combinations may help negotiators reach a better perceived solution. As outlined above, several studies have suggested that negotiation performance may be affected by the richness of the media used (Short et al. 1976; Williams 1997; Whittaker 1995; McGrath and Hollingshead 1993). Negotiation involves resolving conflict between two parties, and thus, there is no optimal solution for both parties that can be assessed through direct performance measurements (such as time and cost). Negotiation success may be best measured by collecting subjective opinions of the negotiators on the satisfaction of their negotiation outcomes. Therefore, we propose the following hypotheses:

H4a: TA helps to reach better perceived solution than T.

H4b: TAV helps to reach better perceived solution than T.

H4c: TAV helps to reach better perceived solution than TA.

Although different media combinations may facilitate reaching a better solution to different degrees, it is useful to further investigate which features associated with the media contribute to the better solution. Kahai and Cooper (1999) studied the effect of computer-mediated communication systems (CMCS) on agreement and acceptance in negotiation tasks. They found negotiation goals were mediated by group process constructs, such as social-emotional communication, task-oriented communication and satisfaction with the process. However, the

Kahai and Cooper's study (1999) only focused on text-based conferencing or email. We seek to further understand how communication constructs impact the perceived success of the negotiation solution for various media combinations. Due to the complex and unstructured nature of the negotiation task, where optimal solutions are difficult to derive, a subjective evaluation criterion (better perceived negotiation solution) is selected over more objective criteria (such as utility). Therefore, we propose the following hypotheses:

H5a: Communication efficiency is positively related to perceived better solution

H5b: Communication effectiveness is positively related to perceived better solution

H5c: Positive social-emotional communication has a positive impact on reaching a better solution

H5d: Negative social-emotional communication has a negative impact on reaching a better solution

4. The Web-Based Negotiation Support System (WebNS)

Based on a previous CBSS **(Collective Bargaining Support System)** developed at McMaster University (Yuan et al 1998), a web-based negotiation support system (WebNS) was developed for this study. WebNS was designed with the following objectives:

- ***Easy access through the web***. Parties from anywhere in the world should be able to negotiate with each other by accessing WebNS through a web browser.
- ***Multiparty communication and interaction***. Negotiation parties should be able to communicate in real-time and interact through a variety of methods, such as hot-line co-ordination, public or private message exchange, and common document building.
- ***Multimedia communication***. Negotiators should be able to use text, audio and video to communicate with each other as they wish.

- ***Structured negotiation process***. Negotiation should be organized in a well-structured process that includes preparation, agenda setting, issue discussion, and final agreement formulation.
- ***Automatic documentation***. The entire negotiation process should be automatically documented. Negotiators should be able to review any issues that have been discussed and any agreements that have been reached.
- ***Security and privacy***. Negotiation information should be saved at a trusted third party location, where information alteration is restricted and access is limited to authorized users. The system should be able to recover from system or communication failures.

The WebNS interface is shown in Figure 2. Based on the above objectives, WebNS was constructed as follows:

- WebNS was written in JAVA and implemented in a Client/Server environment. User registration and session registration are required for successful WebNS access.
- A Hot Line dialogue window is created immediately after logging-in to WebNS. Hot Line communication allows all parties to send and receive short messages and is used to facilitate co-ordination among the negotiation parties. Internet audio and video are also available for multimedia communication.
- The PreSession menu allows negotiators to formulate negotiation items and prepare notes that can be used during the discussion. The Session menu facilitates general discussions, issue discussions and the completion of the final agreement. Through these two menus, negotiators are provided with structured negotiation support.
- All the messages exchanged during a negotiation process are automatically saved in a WebNS server-side database. Negotiation service and server-side storage may be

provided by a third party trustee organization. With a registered user name and password, a negotiator can view the comments and documents created in a previous session. However, no changes can be made to existing content.

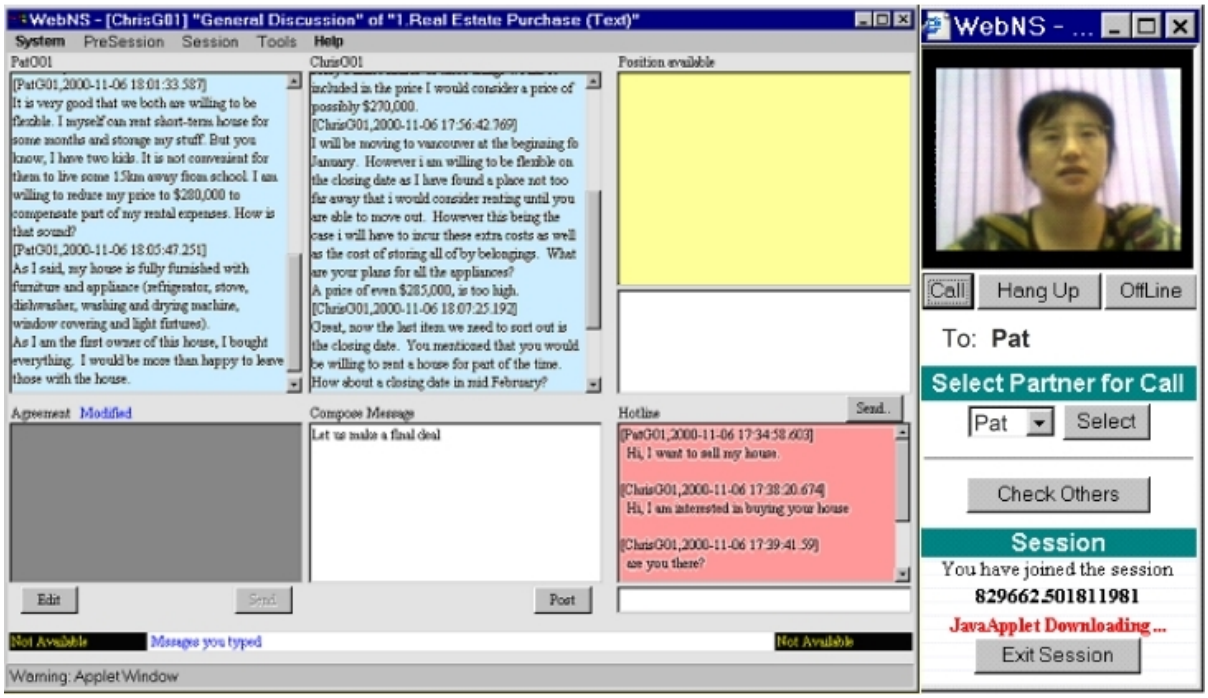

***Figure 2*: The WebNS Interface**

5. Method

To test our research model and hypotheses, we conducted a laboratory study in which subjects were asked to utilize, evaluate and compare two media combinations for negotiation within the WebNS system.

5.1. Subjects

In this study, 120 subjects were drawn from a first year MBA class. Participation in the experiment was voluntary, and the incentive for participating was a 1.5 bonus mark in a required information systems course. More than 56 percent of these subjects had previously joined an online chat, and 28 percent of them had previously used video communication over the Internet

(such as NetMeeting, ICQ). Since most MBA students had at least two years of working experience, they were assumed to have some prior experience in negotiating with others.

5.2. Experimental Tasks

A simulated house purchasing negotiation case was used in the experiment. The subjects were randomly assigned to the roles of house buyer and house seller. In the scenario used for this experiment, the house buyer lives in Toronto, but needs to relocate to Vancouver for a new job. The seller lives in Vancouver, has bought a new house and needs to sell his/her old house quickly. The buyer is very interested in the seller's house, but the initial asking price is too high and the closing date is too late. Both parties, which are remotely located, agreed to use the WebNS system to negotiate a deal, focusing on the house price, closing date and extras (such as window coverings, light fixtures, and appliances). To simulate a remote negotiation scenario, buyers and sellers were physically located in separate rooms during the experiment. After finishing each negotiation session, subjects were asked to complete an online questionnaire where they evaluated the media methods utilized. At the end of the experiment, each subject was asked to compare the two media methods used.

5.3. Experimental Design

The experiment was designed to evaluate and compare three media methods for communication within a Web-based negotiation support system. The three media methods were:

- ***Text (T)***: Buyers and sellers used text only to communicate and negotiate.
- ***Text with Audio (TA)***: Buyers and sellers could use both text and audio to communicate and negotiate.

- ***Text with Audio and Video (TAV)***: Buyers and sellers could use text, audio and video to communicate and negotiate.

Subjects were randomly assigned to evaluate and compare two of the above three media methods. The experiments were conducted in two negotiation rounds, and a total of 6 teams could negotiate in the various negotiation rooms at one time. During the first negotiation round, two teams of buyers and sellers were assigned to use text only (T), two teams were assigned to use text with audio (TA), and two teams were assigned to use text with audio and video (TVA). During the second negotiation round, which directly followed the first round, the negotiation case and the roles of the subjects (as either buyers or sellers) remained the same. However, negotiation partners were switched during the second round as well as the media methods used.

Table 1 illustrates the design of subject and media pairings during the first and second rounds of negotiations. This design ensured there were no potential learning biases due to order effects. Since subjects were not performing negotiations for all three media methods, this was an unbalanced design. This design was chosen to keep the experimental sessions within a reasonable time limit (maximum of 1.5 hours).

***Table 1*: Design of Subject and Media Pairings**

a) First Negotiation Round

	Media Method					
	TA		T		TAV	
Buyer	A1	A2	A3	A4	A5	A6
Seller	B1	B2	B3	B4	B5	B6

b) Second Negotiation Round

	Media Method					
	TA		T		TAV	
Buyer	A6	A4	A5	A2	A3	A1
Seller	B3	B5	B1	B6	B2	B4

5.4. Data Collection

Data were collected using post-negotiation questionnaires. Closed-ended (ordinal and binary) questions were asked as well as open-ended questions that allowed for richer information about subjects' preferences. Questionnaire questions were derived from the constructs outlined in our research model in section 3. For the communication efficiency, communication effectiveness and positive social-emotional communication constructs presented in the model and used in this study, the Cronbach alphas were .769, .703, and .709 respectively. The negative social-emotional communication scale only contained one item and thus, internal reliability was not an issue. Rivard and Huff (1988) suggest that this measure for reliability should be higher than 0.5 and ideally higher than 0.7. Nunnelly (1978) also recommends the Cronbach alpha of a scale should be greater than 0.7 for items to be used together as a construct. Therefore, all our constructs met the recommended criteria for internal reliability.

6. Data Analysis

To test our hypotheses and validate our research model, we performed paired comparisons between the various communications modes (T vs. TA; T vs. TAV; TA vs. TAV). Descriptive statistics for the communication modes are provided in Table 2. To examine the impacts of communication modes on our constructs, paired-samples t-tests were employed, since we could assume the underlying population of the sample means was normally distributed due to our large

sample size (40 samples for each pair-wise comparison). A summary of this analysis is provided in Table 3. To examine the impact of our constructs on the perceived success of the negotiation solutions, a bivariate correlation analysis was performed for intra-subject paired differences (TA-T; TAV-T; TAV-TA) between each construct item and the perceived success of the negotiation solution. A summary of this analysis is provided in Table 4.

***Table 2*: Descriptive Statistics of Communication Modes**

	Communication Mode[2]					
Question[1]	T		TA		TAV	
	m	*sd*	*m*	*sd*	*m*	*sd*
Communication Efficiency:						
Clear Information Exchange	5.26	1.55	5.61	1.14	5.43	1.31
Quick Response	4.02	2.05	5.96	1.28	5.85	1.32
Easy to Use	4.71	1.73	5.82	1.04	5.74	1.31
Communication Effectiveness:						
Strong Expression Power	4.25	1.50	5.29	1.37	5.46	1.23
Easy to Remember Information	5.60	1.18	5.60	1.14	5.41	1.46
Most Comfortable Communication Mode	4.53	1.72	5.42	1.60	5.17	1.50
Positive Social-emotional Communication:						
Encourages Mutual Understanding & Acceptance	3.78	1.49	5.33	1.27	5.33	1.38
Strong Power to Influence Others	3.56	1.61	5.00	1.39	4.84	1.52
Strong Power to be Persuaded by Others	3.34	1.59	3.75	1.62	4.06	1.58

Desirable Mode to Identify Others	0.56	0.50	0.78	0.44	0.74	0.44
Desirable Mode to Identify Oneself	0.49	0.50	0.68	0.47	0.69	0.47
Encourages Mutual Trust	3.54	1.55	5.04	1.40	5.40	1.51
Negative Social-emotional						
Communication:						
Distraction from Problem Focus	3.34	1.47	3.43	1.54	4.31	1.64
Helps Reach a Better Solution	4.00	1.60	5.04	1.44	5.00	1.43

1. Two questions ("desirable mode to identify others" and "desirable mode to identify oneself") were binary measures (no value=0; yes value=1). Other questions were measured using a 7-point Likert scale, which ranged from "strongly disagree" (Likert score = 1) to "strongly agree" (Likert score = 7).

2. T=Text communication; TA=Text with audio communication; TAV= Text with audio and video communication

m = sample mean, *sd* = sample standard deviation.

Table 3: Pairwise Comparisons of Communication Modes

	Communication Mode[2]								
Question[1]	T vs. TA			T vs. TAV			TA vs. TAV		
	p	*sig.*	*Pref.*	*p*	*sig.*	*Pref.*	*p*	*sig.*	*Pref.*
Communication Efficiency:									
Clear Information Exchange	.075	ns		.275	ns		.314	ns	
Quick Response	.000	***	TA	.000	***	TAV	.433	ns	
Easy to Use	.000	***	TA	.000	***	TAV	.642	ns	
Communication Effectiveness:									
Strong Expression Power	.000	***	TA	.000	***	TAV	.424	ns	
Easy to Remember Information	.853	ns		.463	ns		.307	ns	
Most Comfortable Communication Mode	.001	**	TA	.024	*	TAV	.269	ns	
Positive Social-emotional Communication:									
Encourages Mutual Understanding &	.000	***	TA	.000	***	TAV	.902	ns	

Acceptance									
Strong Power to Influence Others	.000	***	TA	.000	***	TAV	.501	ns	
Strong Power to be Persuaded by Others	.088	ns		.003	**	TAV	.161	ns	
Desirable Mode to Identify Others	.030	*	TA	.015	*	TAV	.863	ns	
Desirable Mode to Identify Oneself	.023	*	TA	.010	*	TAV	1.00	ns	
Encourages Mutual Trust	.000	***	TA	.000	***	TAV	.139	ns	
Negative Social-emotional									
Communication:									
Distraction from Problem Focus	.800	ns		.000	***	TAV	.000	***	TAV
Helps Reach a Better Solution	.000	***	TA	.000	***	TAV	.787	ns	

1. Two questions ("desirable mode to identify others" and "desirable mode to identify oneself") were binary measures (no value=0; yes value=1). Other questions were measured using a 7-point Likert scale, which ranged from "strongly disagree" (Likert score = 1) to "strongly agree" (Likert score = 7).

2. T=Text communication; TA=Text with audio communication; TAV= Text with audio and video communication

Notes: a) Paired comparison t-test used for comparison with the following null and alternate hypotheses:

Null Hypothesis ($H_{0i.j.k}$): $\mu_{i.k} - \mu_{j.k} = 0$, where $\mu_{i.k}$ and $\mu_{j.k}$ are the means of communication mode i and communication mode j scores respectively, for item k.

Alternate Hypothesis ($H_{ai.j.k}$): $\mu_{i.k} - \mu_{j.k} \neq 0$

b) *p*=significance level (two-tailed), *sig.* = ns (not significant), * (.05 level), ** (.01 level), *** (.001 level), *Pref.*= the communication mode that was significantly preferred in the given pair testing.

Table 4: Pairwise Correlation of Construct Items with the Final Solution

	Communication Mode[2]								
Question[1]	T vs. TA			T vs. TAV			TA vs. TAV		
	r	*p*	*sig.*	*r*	*p*	*sig.*	*r*	*p*	*sig.*
Communication Efficiency:									
Clear Information Exchange	.578	.000	***	.394	.013	*	.252	.107	ns
Quick Response	.210	.205	ns	.225	.175	ns	.107	.506	ns

Easy to Use	.387	.016	*	.387	.014	*	.020	.901	ns
Communication Effectiveness:									
Strong Expression Power	.647	.000	***	.453	.003	**	.630	.000	***
Easy to Remember Information	.539	.000	***	.027	.871	ns	.508	.001	**
Most Comfortable Communication Mode	.622	.000	***	.549	.000	***	.656	.000	***
Positive Social-emotional Communication:									
Encourages Mutual Understanding & Acceptance	.726	.000	***	.607	.000	***	.790	.000	***
Strong Power to Influence Others	.572	.000	***	.368	.019	*	.613	.000	***
Strong Power to be Persuaded by Others	-.019	.909	ns	.166	.320	ns	-.138	.385	ns
Desirable Mode to Identify Others	.159	.347	ns	.027	.870	ns	.202	.223	ns
Desirable Mode to Identify Oneself	.095	.594	ns	.258	.118	ns	.332	.042	*
Encourages Mutual Trust	.700	.000	***	.443	.005	**	.605	.000	***
Negative Social-emotional Communication:									
Distraction from Problem Focus	.045	.790	ns	.237	.152	ns	-.456	.003	**

1. Two questions ("desirable mode to identify others" and "desirable mode to identify oneself") were binary measures (no value=0; yes value=1). Other questions were measured using a 7-point Likert scale, which ranged from "strongly disagree" (Likert score = 1) to "strongly agree" (Likert score = 7).

2. T=Text communication; TA=Text with audio communication; TAV= Text with audio and video communication

Notes: a) Bivariate correlation calculated for intra-subject paired differences (TA-T; TAV-T; TAV-TA) between each scale item and the perceived success of the final solution ("reach a better solution")

b) *r*=correlation coefficient, *p*=significance level (two-tailed), *sig.* = ns (not significant), * (.05 level), ** (.01 level), *** (.001 level)

6.1. Test H1: Is Communication Efficiency Greater for Richer Media?

Table 3 shows that TA and TVA were significantly quicker ($p < .001$) and easier to use ($p < .001$) than text alone. However adding audio or video communication to text communication did not have a significant impact ($p > .05$) on information clarity. For all construct items, adding video to a TA negotiation environment did not influence the efficiency of communication ($p > .05$). Subjects commented that text was "a little slow" and they "did not know what the other

party was doing when you were typing". Others commented that text with audio was "faster and easier" and that while "there were problems with clarity on the phone line, this form of communication helped speed up the process". On the other hand, video was commented to be "too choppy", "unclear", "blurry", "not in real time" and "not as fast as audio and text only".

Hypothesis H1a and H1b were supported for two of the three construct items. The addition of rich media did not add clarity to the negotiation session since text was already a clear mode for information exchange. However, H1c was not supported for any construct items. The addition of video to a TA environment did not impact the efficiency of communication. Audio and video are more natural means of communicating than text, and thus should result in greater communication efficiency. However, the application of these media modes over the Internet may result in some distortion. In particular, video has higher bandwidth requirements and may result in jumpy, unclear and delayed responses when these requirements are not be fulfilled. In a meta-analysis of over 30 studies, Barber and Laws (1994) reported that video quality had a noticeable impact on communicative tasks.

6.2. Test H2: Is Communication Effectiveness Greater for Richer Media?

The analysis shown in Table 3 indicates that TV and TVA were significantly more comfortable communication modes ($p < .01$ and $p < .05$ respectively) than text alone. Additionally, the addition of audio or audio and video to text communication gave the subjects significantly stronger expression power ($p < .001$). Subjects commented that they were "able to gain information via [speech] tones and body language" and richer media provided for "better communication", was "easier" and "the most familiar forms of communication". However, audio and video communication did not impact the memorability of the information exchanged

($p > .05$). As with communication efficiency, the addition of video to TA negotiations did not influence the effectiveness of communication for any of this construct's items ($p > .05$).

Hypothesis H2a and H2b were supported for two of the three construct items, and H2c was not supported for any of the items. Although video most closely resembles a natural face-to-face environment, poor video quality may impede its potential positive impact. This study also revealed that the addition of rich media did not impact the memorability of the information exchanged. This result appears to contradict earlier work (Nugent 1982; Baggettt and Ehrefeucht 1983; Sipior and Garrity 1992; Archer et al. 1996) where the combination of modality modes assisted in information retention. However, when audio was added to a text environment in our study, subjects tended to neglect text communication and focused on discussing negotiation issues via voice.

6.3. Test H3: Are both Positive and Negative Social-emotional Communications Greater for Richer Media?

Table 3 shows that TAV was a significantly positive social-emotional communication mode when compared with text alone. Adding either audio or audio and video to text significantly encouraged mutual understanding and acceptance ($p < .001$) and mutual trust ($p < .001$). TA or TAV were preferred communication methods for identification of either negotiation party ($p < .05$), when compared to text alone. Specifically, subjects stated that "the audio format enhanced the flow of communication and humanized it", they "did not like talking with strangers" and audio and video provided "some level of familiarity with the person you are talking with". The addition of audio or audio and video to text helped to "lighten the atmosphere", "put a face and voice to a name", which was important "particularly when dealing with so much money". One subject commented that "it is always great to be able to have a little informal small talk before

getting right into a negotiation setting" as it "helps both parties to get comfortable and establishes a rapport", while another subject agreed that initial small talk helped her "to get to know the human side [of the other party] rather than regarding them as simply '*something*' with whom I want to barter".

Although subjects indicated that the addition of both audio or audio and video to text gave them significant power to influence others ($p < .001$), they could only be significantly persuaded by others ($p < .01$) when both audio and video were added to text communication. Subject stated that "seeing the facial expressions [of the other party] influenced negotiation tactics" and allowed them to "judge more precisely" how the other party "is reacting to your suggestions". Therefore, for positive social-emotional communication, Hypothesis H3a was supported for five of the six construct items, and H3b was fully supported for all items.

However, as with communication efficiency and effectiveness, the addition of video to TA negotiations did not significantly influence any items in the positive social-emotional communication construct ($p > .05$). Hypothesis H3c was not supported. Subjects stated that they "did not want appearance to be part of the negotiation", "did not feel confident in front of a camera", and video appearance may "skew the negotiation". Interestingly, one subject made the following comment: "As a female, I do not want to be identified during negotiation. I think the word itself will give me more power in controlling the whole process". Another subject commented that due to "the slight time lag, the video was more like a series of images, with the other individual never making eye contact [which is] rather important in face-to-face negotiations". This observation was also made by Mühlfelder et al. (1999). Video cameras are typically placed on top of a monitor or beside a monitor, rather than inside the screen where the picture of the partner is displayed. This positioning of equipment results in negotiation partners

that never look directly at each other. This lack of eye contact may impede the potential impact of video communication in a negotiation setting.

Only one item was included within the negative social-emotional communication construct. Table 3 shows that adding audio to text communication did not distract subjects from the problem focus. However, the addition of video communication to either T or TA environments did significantly distract users away from focusing on the negotiation problem. Subjects commented that they "did not particularly like video streaming" as it "appeared chopped up and it distracted away from the purpose of the meeting". Others stated that "video was just distracting and didn't add to the negotiating", whereas "audio was just like talking on the phone" and was "a more natural way to communicate". Therefore, for negative social-emotional communication, Hypothesis H3a was not supported, while H3b and H3c were supported. This result is in line with early research by Festinger and Maccoby (1964) that proposed video channels can distract people from the focal task.

6.4. Test H4: Does richer Media Help to Reach a Better Negotiation Solution?

Subjects agreed that the application of audio or audio and video to a text environment resulted in a significantly better negotiation solution ($p < .001$). However, adding video to a TA environment did not impact the perceived success of the negotiation solution ($p > .05$). For text communication, subjects commented that it was "slow" and "since you didn't know what the other person was doing, the mind tended to wander" and "agitation increased". This did "not lend itself well to an open negotiation process". Similarly, the anonymity of text communication did "not allow a bond to form between the buyer and seller". This bond "is important to build trust on both sides in order to reach a mutually beneficial agreement". On the other hand, video was viewed as "too distracting", "superfluous" and "not really aiding negotiation at all".

However, “audio was helpful since it was quicker and more efficient than simply typing”, while allowing negotiators “to be comfortable with each other”, “encouraging trust which is important to negotiation success”. Therefore, hypothesis H4a and H4b were supported, while H4c was not.

6.5. Test H5: What Factors Are Positively or Negatively Related to the Perceived Success of the Negotiation Solution?

Examining the impact of efficiency items, Table 4 reveals that there is a positive correlation between information clarity and the perceived success of the negotiation solution when audio is added to text ($p < .001$) and when both audio and video are added to text ($p < .05$). Similarly, ease of use is positively correlated with a better negotiation solution for audio added to text ($p < .05$) and for both audio and video added to text ($p < .05$). However, a quicker response time did influence the perceived success of the negotiation. As with hypothesis H1 results above, adding video to a TA negotiation environment did not cause communication efficiency to impact ($p > .05$) the perceived success of the negotiation solution. Therefore Hypothesis H5a is supported for T vs. TA and T vs. TAV communication along two of the three construct items, but is not supported for TA vs. TAV communication.

For effectiveness items, Table 4 shows that adding richer media (i.e. adding audio to text; adding audio and video to text; adding video to audio and text) results in a significantly positive correlation between expression power and the perceived success of the negotiation ($p < .01$ or $p < .001$). Similarly, adding richer media results in a significantly positive correlation between communication comfort and the perceived success of the negotiation ($p < .001$). However, the memorability item did not display comparable results. The T vs. TA combination and the TA vs. TAV combination showed positive correlations ($p < .001$ and $p < .01$ respectively) between memorability and negotiation success, however T vs. TAV combination was not significant in

this regard. Therefore hypothesis H5b is supported for T vs. TAV communication along two of the three construct items, and is fully supported for T vs. TA and TA vs. TAV communication.

Examining the impact of positive social-emotional communication, Table 4 illustrates that there is a positive correlation between both mutual understanding/acceptance and mutual trust with the perceived success of the negotiation solution when richer media is added ($p < .001$). It is interesting to note that when richer media is added, subjects felt their power to influence others positively correlated with the success of the negotiation solution ($p < .001$ or $p < .05$), while the power to be influenced or persuaded by others did not ($p > .05$). In other words, subjects felt they could influence the negotiation outcome by persuade others through richer media, but they could not be persuaded by others.

Generally, subjects did not feel the impact of richer media on identifying themselves or others correlated with negotiation success. Only when video was added to a TA environment, did subjects indicate that identifying themselves positively correlated with negotiation success ($p < .05$). Therefore, hypothesis H5c is only partially supported for T vs. TA (three of the six construct items), T vs. TAV (three of the six construct items) and TV vs. TAV (four of the six construct items).

Table 4 also indicates that the addition of video in a TA environment resulted in a negative correlation between distraction and solution success ($p < .01$). In this case, the addition of video increased subjects' distraction level, which decreased the perceived success of the negotiation solution. Therefore, hypothesis H5d is supported for TV vs. TAV communication, but not for T vs. TA or T vs. TAV communication.

7. Conclusions

In this paper we examined the impacts of multimedia combinations on detailed items within various communication constructs, including communication efficiency, effectiveness and social-emotional communication. Additionally, we extended this analysis to understand how these detailed construct items impact the perceived success of the negotiation solution. Therefore, this paper provides a more complete view of multimedia communication effects on web-based negotiation.

There are several potential areas for future research in multimedia web-based negotiations. First, future research may explore how different media is used at various stages of the negotiation process. Negotiations may involve several stages, such as greeting, background information exchange, agenda setting, issue discussion, and final agreement formulation, and different media may be used by negotiators to perform different tasks. Second, more research is needed to fully understand how different forms of media complement one another. Although multimedia combinations were used in our experiment, we did not explicitly examine the utilization of specific media within the combinations. Although we observed that negotiators tended to neglect text communication when audio or video channels were available, more precise utilization measures are needed to understand the preferences and usability of each media. Third, the effects of multimedia communication in an online negotiation environment should be examined along multiple performance measures. Our study used perceived success of the negotiation solution as an overall performance measure. Other measures for negotiation outcomes include agreement and acceptance (Kahai and Cooper 1999), and consensus change (Mennecke et al. 2000; Yoo and Alavi 2001). Efficiency is also a common performance measure, which may be calculated by the time required to reach an agreement. Further

validation of this research can be achieved by examining the multimedia effects on various performance measures.

It should be noted that the conclusions of this research are based on current technology. While online audio communication is of acceptable quality, Internet-based video is currently hindered by bandwidth and resolution limitations. These restrictions may fade away as more and more businesses and individual users are connected to broadband communication. As technology advances, it is important to continually explore and re-examine multimedia options to support web-based negotiations.

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