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A Study of Integrative Bargaining Model with Argumentation-Based Negotiation

Jinsoo Park [1], Hamirahanim Abdul Rahman [2], Jihae Suh [3,*] and Hazami Hussin [4]

1 Department of Management Information System, Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul 08826, Korea; jinsoo@snu.ac.kr
2 Faculty of Industrial Management, Universiti Malaysia Pahang, Lebuhraya Tun Razak, Kampung Melayu Gambang, Gambang 26300, Pahang, Malaysia; hamira.rahman@gmail.com
3 Big Data Institute, Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul 08826, Korea
4 Universiti Teknologi MARA Cawangan Melaka, Kampus Jasin, Merlimau, Melaka 77300, Malaysia; hazami054@uitm.edu.my
* Correspondence: jihaesuh77@sun.ac.kr; Tel.: +82-10-8770-3593

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Abstract: E-commerce is increasingly competitive and there is a constant need for new approaches and technology to facilitate exchange. Emerging techniques include the use of artificial intelligence (AI). One AI tool that has sparked interest in e-commerce is the automated negotiation agent (negotiation-agent). This study examines such agents, and proposes an offer strategy model of integrative negotiation for a negotiation-agent with a focus on negotiation agent-to-human interaction. More specifically, a new offer strategy was developed based on the integrative bargaining model, which emphasizes the importance of exchanging information among negotiators and multi-issue negotiation that includes package offers to achieve an integrative (win-win) outcome. This study incorporated an argumentation-based negotiation and the negotiation tactic of multiple equivalent simultaneous offers, which was programmed into the negotiation-agent. An experiment was conducted performing 49 negotiation-agent-to-human negotiations over three issues in online purchase tasks to demonstrate the effectiveness of the proposed strategy. Experimental results indicated that the proposed offer strategy with agent negotiation can enhance the persuasiveness of an offer and the performance of negotiation outcome (human counterpart's perception toward negotiation process, opponent–agent and desire for future negotiation). The findings confirmed the effectiveness of the proposed design and demonstrated an innovative approach to e-commerce transactions.

Keywords: automated negotiation; multiple equivalent simultaneous offer; integrative negotiation; argumentation-based negotiation; software agent

1. Introduction

Negotiation could be straightforward and conventional, such as bargaining over a price in a marketplace or determining on a meeting time or venue. It can also be complicated and extraordinary, such as involving international arguments and nuclear disarmament, which can impact the well-being of millions [1]. According to Carnevale & Pruitt (1992, 1981), negotiation is defined as a procedure to resolve differing preferences among parties involving discussion with the aim of attaining agreement. Negotiation has also been defined as a process that involves decision making in a conflict between two parties while working together to achieve a satisfactory outcome [2]. Negotiation exists in many professional subsets (e.g., business activities and legal proceedings) as well as private subsets (e.g., parenting and everyday life). It is also a pervasive activity and complex phenomenon appearing in many scientific fields, with a variety of very distinct approaches.

The negotiation process and successful completion is not an easy task depending on the complexity of a particular negotiation and the environment [1]. Successful negotiation, however, is critical to the negotiator. Therefore, it is crucial for negotiators to understand how to efficiently approach negotiations to reach a reasonable and mutually-beneficial settlement [3]. Unfortunately, it is often challenging for human negotiators to recognize and make required trade-offs to attain optimum results due to restricted information processing capacity and capability, cognitive biases, and social-emotional difficulties [4,5].

Artificial intelligence provides an opportunity and methods to transform from human-human negotiation to automated negotiation by implementing agent-based modeling. Such transformation is also important because of the fast growth of electronic markets (e-markets) requiring technologies to support human business decision-makers. Over past decades, a variety of negotiation models have been developed [6,7] and these can be applied to e-commerce and adapted for use by organizations.

Automated negotiation is interaction among a group of agents (software agents) in competing for interests and a willingness to collaborate to come up with a mutually-acceptable agreement regarding some belief, goal or plan [4,8,9]. Therefore, comprehending the relationships between parties during the negotiation phase is a very significant problem in automated negotiation [4]. Automated negotiation research has three primary research streams: negotiation protocols, negotiation objects, and agent decision-making models [9]. Negotiation protocol refers to the flow of information between negotiating parties that is bound with the set of rules by which negotiating parties must abide [9]. Negotiation object is the scope of the issue or item over which agreement must be reached (e.g., price) [9]. Last, agent decision-making is the decision-making object that participants employ with the negotiation procedure to reach their goals [9].

The formalization of automated negotiation started in the 1980s from the multi-agent community [10]. Automated negotiation can significantly decrease transaction costs associated with humans [4–6] and may increase the efficiency of negotiation time and settlement [4,5,10]. It can also eliminate some of the uncommunicativeness and unnecessary human behavior that is typical during negotiation (e.g., personalities being offended) [10,11].

2. Study Background

Negotiation is a method by which individuals settle differences. Negotiation theorists usually distinguish between two kinds of negotiation: (1) distributive negotiation and (2) integrative negotiation [12]. Distributive negotiation is also known as "win-lose bargaining" due to the assumption that one individual's gain is another individual's loss. It works under a zero-sum condition and suggests that any gain of one party is made at the expenditure of the other and vice versa. In distributive negotiation, each side often takes up an extreme or fixed position, knowing it will not be accepted and then seeks to yield as little as possible in attaining a deal. Distributive bargainers consider of negotiation as a procedure of distributing a fixed amount of worth. The final goal under distributive negotiation is not to have a "win-win" kind of situation, but to have one side win as much as possible. Both parties will try for the maximum share of the asset or resource that needs to be distributed. An example of distributive negotiation is haggling over prices in an open market, such as for the price of a car or a home.

The second type of negotiation is integrative negotiation, also known as "win-win" negotiation. An integrative negotiation involves a situation where the interests or purposes of each negotiator are not mutually exclusive. This negotiation contains more than one interest or objective. An integrative negotiation permits the negotiators to be inspired in the negotiation procedure and make innovative or additional worth for both parties. It often relates to a higher amount of trust and the establishment of a relationship. It can also relate to innovative problem-solving that aims to get mutual gains. An integrative negotiation approach is shared problem-solving, rather than a personalized interest, and persists upon devotion to objective principled criteria as the basis for agreement [13]. In theory, an integrative negotiation permits for an optimal product for all parties without leaving any

potential values unclaimed, a long-term relationship, and a mutually satisfactory outcome that benefits everyone involved [14]. A common example of integrative bargaining is the expanding pie model, whereby, if both parties work together to make a bigger pie, then both can have more with the same percentage division.

At the beginning of the 21st century, digitization led to an increase in the automation of negotiation. Automated negotiation grew increasingly important with the development of new technologies (i.e., artificial intelligent technology) for the web and e-commerce [15]. Popular online auctions increasingly utilize automated negotiation trade for e-commerce [15]. There are several forms of automated negotiation: (1) human-to-human negotiation, (2) agent-to-agent negotiation and (3) agent-to-human negotiation [6]. Human-to-human negotiation with a computer-mediated negotiation support system (NSS) involve decision-support systems that emphasize the computer-based decision and communication to assist a human negotiator, and the autonomous agent does not have autonomy in control [6]. Meanwhile, agent-to-agent negotiation is described as software agents representing both parties of negotiators performing a negotiation process. The goals of these interactions are to make other agents take on a specific path of action (e.g., perform a specific service), change an intended course of action (e.g., delay or bring forward a specific activity so that there is no longer a conflict), or come to an agreement on a typical course of action [6,15]. Design for an automated negotiation agent for agent-to-human negotiation is totally different from agent-to-agent negotiation. Agents need to be equipped with a decision-making mechanism to adapt to a negotiating partner's behavior [15]. It is essential to explore the potential effects of the complexity of the negotiation assignment to gain more in-depth insights into agent-to-human negotiations [3]. Agent-to-human negotiations requires far more intelligent agents to negotiate efficiently with human negotiators [6].

Automated negotiation research revealed several benefits that computerized negotiation can offer to e-markets. These benefits include: (1) better deal (win-win settlement); (2) decreased transaction cost and time associated with human operation; (3) increased efficiency of settlements even for semi-structured, multi-issue business bargaining problems; and (4) minimizing of some negative aspects of human negotiation, such as avoiding face-to-face encounters with people who are uncomfortable with "bargaining" [5,16,17]. Unfortunately, a poorly designed automated negotiation agent will not be able to deal effectively with a skillful human counterpart that can adopt flexible strategies [5,17].

Our aim was to develop an enhancement offer strategy model for integrative negotiation. The offer strategy model was based on the multiple equivalent simultaneous offers by an automated negotiation agent for software agent-to-human negotiation. Based on social-psychological analysis, a negotiator can be more determined and persuasive on the worth of an offer using the multiple equivalent simultaneous offers technique [5,18]. Therefore, we were interested in studying the additional part that can be incorporated with multiple equivalent simultaneous offers, to make the offer more convincing and attractive. Two research questions were proposed:

(1) *Does the MESOArgN strategy enhance the persuasiveness of an offer?*
(2) *Will the MESOArgN strategy enhance negotiation outcome?*

We intended to establish the offer strategy model of integrative negotiation into the decision algorithms that were programmed in an automated negotiation agent. Then we performed an experiment with the automated negotiation agent in the e-market setting and tested its capabilities.

Previous Study

There are numerous automated negotiation studies. Previous research has addressed the information asymmetry issue in agent-agent negotiation and used a variety of machine-learning techniques to make inferences about counterparts, including their resistance points, preference and possible tradeoffs [19–21]. However, several crucial issues are yet unaddressed, such as strategic choice [6]. Previous studies mainly focused on specific negotiation protocols, the library of negotiation

strategies, and trade-off strategies [4,6,11]. Most studies proposed an agent limited to a specific communication channel [11]. Hence, they did not address a critical characteristic of human behavior where a human speaks and expresses their preferences [11]. Moreover, existing studies focused on agent design with assumptions about the availaibility of past negotiation history [11,19,20].

3. Theoretical Background

Research on negotiation behavior has three theoretical traditions: (1) the individual differences approach, (2) the motivational approach, and (3) the cognitive approach [22]. The individual differences approach studies the kinds of personal characteristics that affect negotiation behavior, the negotiation process and outcome [23,24]. The motivational approach seeks to develop how negotiator objectives and objectives effect negotiating behavior and the consequential outcome. The cognitive approach tries to determine how individual negotiators acquire and use knowledge in negotiation [23,24]. The cognitive approach is grounded in information processing theory [22,24,25], which suggests that when individuals experience events, saved information is triggered in the mind and is then used to reach the next decision [23].

3.1. Integrative Bargaining Model

The goal of integrative negotiation (also known as "non-zero-sum-game" or "win-win game") is to attain a mutually-beneficial agreement that maximizes settlement efficiency and fairness under suitable circumstances [5]. Integrative approaches employ objective criteria to make a circumstance of mutual gain and emphasizes the significance of exchanging information among the negotiators [26]. Walton and McKersie (1965) described the integrative bargaining model as a negotiation approach in which negotiators employ problem-solving behavior that refers to a state of desire for finding a solution to the problem to reach a definite goal. Problem-solving is generally recommended to achieve an integrative settlement [27,28]. Negotiators attempt to redefine the problem, analyze the cause of settlement difficulties and explore a wide range of mutually-acceptable alternative solutions through maximum information sharing and disclosure of each party's needs and interests [28–30]. The effectiveness of the problem-solving approach depends upon the presence of some psychological and information conditions: motivation, information and language, trust and a supportive climate [12]. Motivation describes how parties must have the motivation to solve the problem and thus anticipate the problem as significant enough to address and discuss [12]. Information and language state that those participating in the problem-solving process must have contact to appropriate information relevant and be authorized to use it [12]. Meanwhile, the trust and support climate is marked by encouragement and freedom to behave spontaneously without fear of sanctions [12].

3.2. Social Judgment Theory

Social judgment theory (SJT) was suggested by Carolyn Sherif, Muzafer Sherif and Carl Hovland in 1961 and is a framework that studies human judgment. According to this theory, a person's attitude change will be influenced by a cognitive judgment process in which a proposed position is compared with a person's existing attitude [31]. Attitude change is the fundamental objective of persuasive communication (McGuire, Lindzey & Aronson, 1981). The theory explains the internal procedures of an individual's decision of a interconnected message [31]. There are three zones or latitude in SJT: (1) latitude of acceptance, (2) latitude of non-commitment, and (3) latitude of rejection. Latitude of acceptance describes the range of positions a person is ready to accept or agree on the communicated message [31]. Latitude of non-commitment is the range of positions where a person feels neutral or indifferent about the communicated message [31]. Latitude of rejection states the range of positions a person finds objectionable in the communicated message [31].

3.3. Research Model

Underpinned by the integrative bargaining model and social judgment theory (refer to Diagram 5), the context of the research model is described in terms of multiple equivalent simultaneous offers and argumentation-based negotiation as an offer strategy (MESOArgN). We created the term, MESOArgN, to describe this proposed offer strategy. We explain how the anticipation of negotiation result changes when the software agent makes that offer strategy. With the addition of two research model diagrams, we added another factor, success rate, to the research study.

3.3.1. Negotiation Offer Strategy

Offer strategy is the action plan associated with the decision of negotiator to suggest an offer to the other party. To make negotiation successful, we suggested the offer strategy model that includes two features in negotiation: argumentation-based negotiation (as strategy) and multiple equivalent simultaneous offer (as tactics). The offer strategy model was based on the integrative approach and negotiation theory, which emphasizes the significance of exchanging information among negotiators [26]. Meanwhile, multi-issue negotiation that contains package offers helps to reach a mutually acceptable (win-win) result [32].

3.3.2. Multiple Equivalent Simultaneous Offer (MESO)

The multiple equivalent simultaneous offer (MESO) tactics was suggested as an alternative to basic strategies such as sequential-single offer. The MESO technique lets the negotiator provide the other negotiator(s) with multiple offers that are mutually equal at each round. For instance, a software vendor can simultaneously offer three similar software packages to a client: $1 million software package with payment in 30 days, the same software package for $1.5 million with payment in 120 days, or an enhanced software package for $1.35 million with payment in 30 days. Negotiation theory and previous researches have proven that multi-issue negotiation including package offers is superior in reaching an agreement to single-issue negotiation [32]. According to a research, users who highly value choice prefer being offered with multiple options to with single one [33] and mutual benefits can be gained when both sides are using MESO [32]. Furthermore, an experiment on human-to-human negotiation demonstrated that when the MESO technique is used, acceptance rate goes up, and the other party's satisfaction with the offer also increases [5,32].

3.3.3. Argumentation-Based Negotiation (ABN)

Argumentation theory is the interdisciplinary study of how deductions can be reached by logical reasoning. Logical reasoning is based on claims, if sound or not, and on premises. It includes the arts and science of civil debate, persuasion, dialogue and conversation [34]. Arguments constitute the key part of real-life negotiations on personal matters (e.g., a fight between family members over which TV channel to watch), and also extend to business deals (e.g., a contract between the supplier and the retailer). In the context of negotiation, an argument is viewed as a piece of information that may permit an agent to justify its negotiation viewpoint and influence the other agent's negotiation viewpoint [8]. For instance, in a trade union argument, an agent representing the workers' union might refuse an offer for a modified pension plan proposeded by the organization's management. As a response, the management agent might offer a different pension plan [8] to persuade the workers' union agent to accept it as a win-win settlement. It is necessary to incorporate arguments into the negotiation model for the following two reasons: (1) argumentation is a tool in the negotiation process in which an agent gathers information and strategically discloses the information to adjust utility functions and to update beliefs of the other party [35]; (2) in reality, agents frequently have limited (as opposed to zero or full) knowledge of all the situations around the negotiation, and argumentation is used by an agent to influence its opponent by strategically providing selected pieces of information to the opponent [35].

3.3.4. Integrative Settlement

The goal of integrative negotiation (also known as "non-zero-sum game" or "win-win game") is to accomplish a mutually beneficial agreement maximizing settlement efficiency and fairness under proper circumstances [5]. Integrative settlement employs objective criteria to make the condition of mutual gain and emphasizes the importance of exchanging information among the negotiators [26]. Integrative negotiation was explained by Richard Walton and Robert McKersie (1991) as a negotiation approach in which negotiators employ problem-solving behaviors. Problem-solving is generally recommended for achieving an integrative settlement [27,28]. Negotiators attempt to redefine problems, analyze the causes of settlement difficulties, and explore a wide range of mutually acceptable, alternative solutions through maximum sharing of information and disclosure of each party's needs and interests [27–29]. A supportive and trusting approach facilitates joint problem-solving [12]. Building trust is absolutely essential in negotiation [29] because the negotiators must have sufficient trust that others will use the information only for the purpose of problem solving [12].

3.3.5. Counterpart's Social-Psychological Outcome

SJT is originated from social psychology. It is a scientific study of how the real, perceived or inferred existence of others [36]. Measuring negotiation performance is based on the social perception concept, which includes most features of the perceivers' social worlds such as people, their behaviors, and the situation [22]. According to Thompson, a counterpart's social-psychological outcome consists of three important parts: (1) perception of negotiation situation, (2) perception of the other party, and (3) perception of the self [22,37]. Perception of negotiation situation describes judgement and feeling about the negotiation process in terms of fairness and justice [22,37]. Perceptions of the other party describes a individual's perception and impression development applied to one's negotiation counterpart, for example, cooperativeness and friendliness [22,37]. Lastly, perception of the self involves turning the individual perception procedure inward [22,37].

3.4. Hypothesis Development

The goal of negotiations is to achieve an outcome that contents both parties. Negotiation results could be measured by two types: integrative settlement (refer to Figure 1) to create an agreement benefical for both parties [38]; and a counterpart's social psychological outcomes (refer to Figure 2), the subjective social perceptions held by negotiating parties following the encounter [22,39].

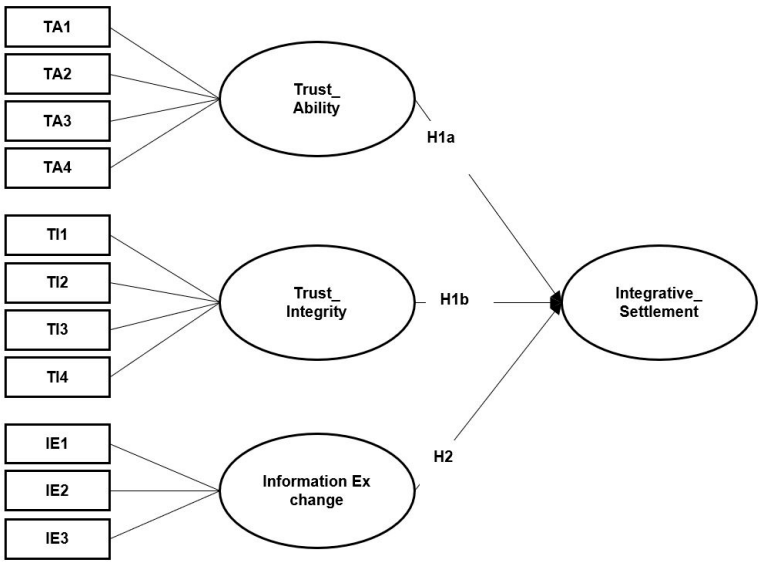

Figure 1. Research model 1.

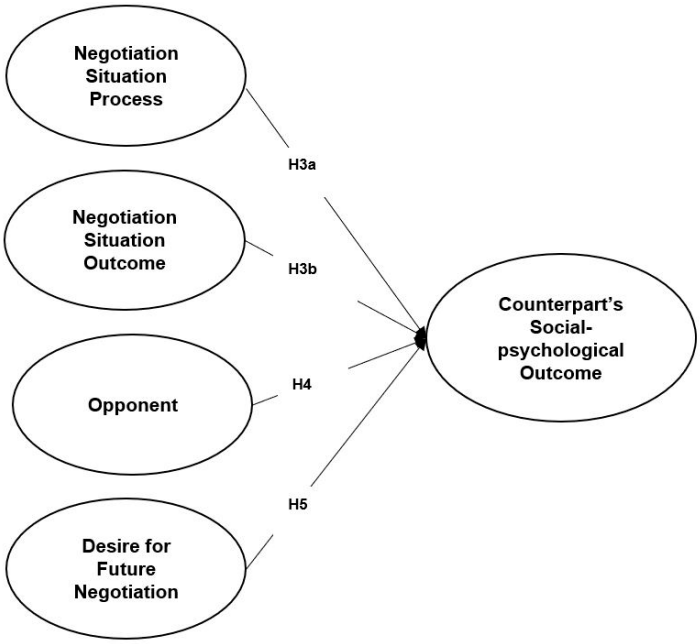

Figure 2. Research model 2.

3.4.1. Trust

Building trust is absolutely essential in negotiation [38] because the negotiators must have adequate trust that others will use the information only for problem-solving [12]. As such, the work can only be delegated to the designated party if they can be trusted without a constant need for inspection of their work [40]. Trust consits of several beliefs such as dealing with ability (competence/intelligence) and integrity (honesty) [41]. Therefore, we offer the following hypotheses:

Hypothesis 1a: *Human negotiator trust in the ability of the software agent negotiator will have a positive influence in reaching an integrative settlement.*

Hypothesis 1b: *Human negotiator trust in the integrity of the software agent negotiator will have a positive influence in reaching an integrative settlement.*

3.4.2. Information

Information is crucial to problem-solving and there is a relatively great emphasis on fact-finding [12]. Negotiators share information and disclosure of each party's needs and interests to find a mutually acceptable solution [22,28,29,42]. Hence, we provide the following hypotheses:

Hypothesis 2: *A human negotiator that provides information about his/her interest to the software agent negotiator will have a positive influence on acceptance of the offer and reaching of an integrative settlement.*

3.4.3. Perception of Negotiation Situation

Perception of negotiation condition relates to a negotiator's decisions on the negotiation procedure and result, such as their decision about the fairness of the procedure and the result of the negotiation. It also includes a viewpoint of the negotiation structure task: purely competitive, cooperative or integrative [22]. Cognitive psychology studies indicate that human decision makers tend to assign more positive attribution to the choice they made after the event of choosing (Yang et al., 2012).

The argumentation is persuasive because exchanges are able to alter the mental state of the agent involved [43]. By using MESOArgN, we suggest the following hypotheses:

Hypothesis 3a: *Compared to a SOArgN offer strategy, a MESOArgN offer strategy will have a positive influence on the negotiation process, which leads to satisfaction in the counterpart's social-psychological outcome.*

Hypothesis 3b: *Compared to a SOArgN offer strategy, a MESOArgN offer strategy will have a positive influence on the negotiation outcome, which leads to satisfaction in the counterpart's social-psychological outcome.*

3.4.4. Perception of Other Party

Perception of other party relates to a negotiator's decision regarding their negotiation opponent, such as about intelligence, sociability, expertise, skill, ability, cooperativeness and competitiveness [22]. Buyer's satisfaction with negotiation is critical; researchers found that levels of satisfaction with an agreement may affect cooperation and desire for continued contact between the parties [44]. By using the proposed offer strategy, we posit the following hypotheses:

Hypothesis 4: *Compared to a SOArgN offer strategy, a MESOArgN offer strategy will have a positive influence on a software agent negotiator's cooperation, which leads to satisfaction in the counterpart's social-psychological outcome.*

3.4.5. Desire for Future Negotiation

The desire for future negotiation relates to a negotiator's subjective evaluation and perception of the negotiation condition and the perception of the other party. Satisfaction with the present negotiation situation may affect the negotiator to work together with the other party in the future. By using the proposed offer strategy, we expect the following hypothesis:

Hypothesis 5: *Compared to a SOArgN offer strategy, a MESOArgN offer strategy will increase the human negotiator's satisfaction with the negotiation process and outcome as well as the perceived cooperation of the software agent negotiator and will be positively influenced with a desire for future negotiation.*

3.4.6. Settlement Ratio

This study also used settlement ratio, which refers to the number of successful or unsuccessful negotiation cases over the total number of negotiation cases [45]. By making a multi-equivalent simultaneous offer in each round, the agent communicates a high concern for the counterpart by increasing the probability that the offer appeals to the counterpart (Yang et al., 2012). On the other hand, argument quality has proven to be an important factor influencing information usefulness and knowledge adaption [46]. By using the MESOArgN strategy, we propose the following hypothesis:

Hypothesis 6: *Compared to a SOArgN offer strategy, a MESOArgN offer strategy will have a higher settlement ratio (success rate).*

4. Research Methodology

This study implements a design science research method. Design is a problem-solving paradigm that seeks to create innovation and define ideas, practices, technical capabilities and products through which the analysis, design, implementation and use of the information system can be effectively and efficiently accomplished [47]. Design science research in information systems must yield an artifact in the form of either construct, model, method or instantiation [47].The effectiveness, reliability,

and efficacy of a design artifact must be established throughly through well-established methods of evaluation [47]. Negotiation research typically uses experiments and surveys the research methods that use the predetermined instrument producing statistical data. [48]. The goal is to identify the determinants of negotiation outcomes [22] such as the relation between the parameter of the different outcomes. [48,49]. The research approach in this study consist of three methods:

i *Prototype/IT artifact*—we developed the negotiation interface in e-commerce as an IT artifact. Besides that, we also established a decision algorithm that is programmed as the automated negotiation agent for the software agent-to-human negotiation. The software agent represents the seller, and the human is the buyer.

ii *Laboratory experiment*—an experimental study designed to test the hypotheses. The experiment is completed in three phases: pre-negotiation, during negotiation and post-negotiation. In the pre-negotiation phase, participants were informed about the general instructions and processes of the experiment. In the second phase, the negotiation phase, the participants negotiated with the automated negotiation agent until they reached an agreement or until the negotiation was terminated without an agreement, whereby the participants rejected the automated negotiation agent's final offer.

iii *Post-negotiation*—the stage after negotiationis completed. Participants were required to record the negotiation procedure. During the post-negotiation stage, participants were asked to complete the questionnaire reflecting on their perceptions on negotiating parties following the encounter.

4.1. Design—System Architecture

An IT artifact, prototype of the negotiation offer strategy and chatbot for automated negotiation agent in the e-commerce portal were designed for the agent-human negotiation. They were developed using Php and MySQL languages. The e-commerce website was accessible at compute2u.name.my. The essential functional modules of the system include the negotiation agent that implemented the negotiation offer strategy (See Figure 3). Another function implemented in system is the chatbot for interaction between negotiation agent and human. The chatbot is artificial intelligence (AI) software that can simulate a conversation (or a chat) with a human in natural language through websites [50]. The negotiation agent represented the seller and the human negotiator represented the buyer.

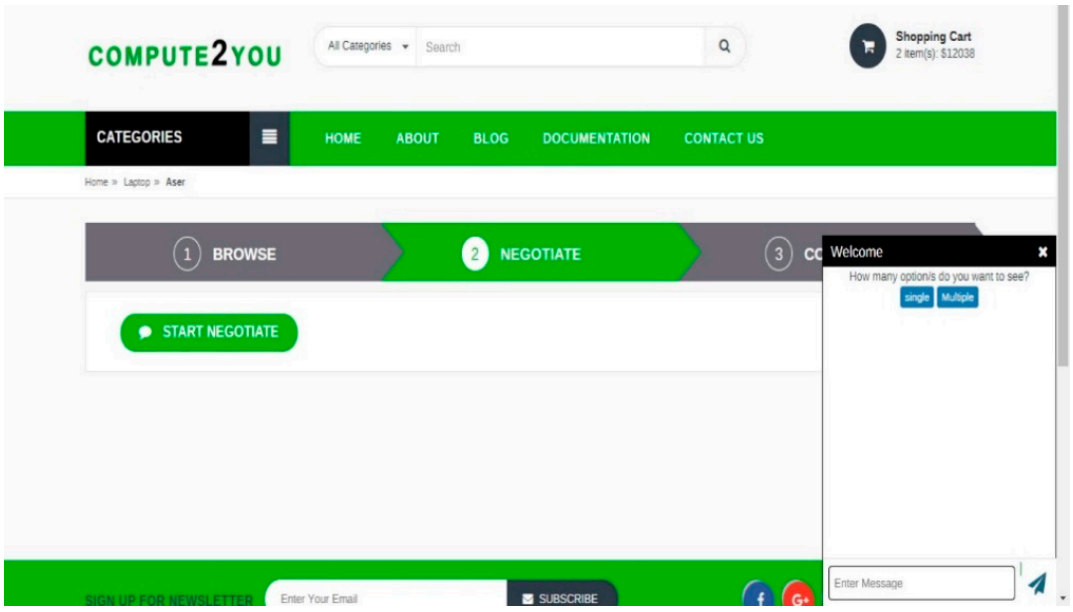

Figure 3. compute2u.name.my.

The negotiation process started after the buyer selected a product and logged in to the website. In the negotiation offer strategy, the negotiation agent compares counteroffer utility to check if it falls within the negotiation agent's acceptance or rejection region. If the counteroffer falls in the acceptance region, the negotiation agent will feedback "accept". If the counteroffer falls in the rejection region, the negotiation agent will feedback "failed" and will forward the counteroffer to the administration of the website for a record for future reference and analysis. Meanwhile, the chatbot will provide an option for the buyer to choose the offer strategy before proceeding with the negotiation process. Following is the screen capture of the chatbot prototype.

4.2. Measurements

To empirically validate the design hypotheses and the prototype, we conducted a 1 x 1 factorial within-subject experiment. The human subject for the role of the buyer interacted with the seller negotiation agent using the negotiation offer strategies that were designed. The negotiation offer strategies rules were reinforced by the prototype and were applied to all the situations.

A three-issues negotiation task was adapted from the negotiation literature review. The task comprised three negotiation issues: unit price, warranty and delivery date. There were nine options for unit price, seven options for warranty and four options for delivery date (Table 1). Therefore, the combination of the value options of the three issues formed a total of $9 \times 4 \times 3 = 108$ alternatives to the final agreement.

Table 1. Negotiation issue.

Unit Price	**$6789**	**$6699**	**$6499**	**$6129**	**$5889**	**$5589**	**$5249**	**$5166**	**$4689**
Warranty	36 months		24 months		18 months		12 months		
Delivery Date	7 days				9 days			14 days	

4.3. Material

Negotiation task, negotiation guideline and questionnaire (refer to Table 2) were developed for the experiments. A negotiation task was about the online purchase of a laptop with three issues comprising unit price, warranty and delivery date. The task was simulated from a validated negotiation scenario based on real-world manufacturing contract negotiations, originally developed by Jones (1988) and used in experimental negotiation studies [5,20]. The different simulated task was used for an individual buyer instead of a buyer that represented a company.

Negotiation guidelines is a reference document for the user. The document describes the broad advise (step by step) in following the negotiation stage procedure. The aim was to streamline particular processes or procedures according to an asset routine. The survey questionnaire was designed to generate specific responses from the participant based on their evaluation after the experiment was conducted. The questionnaires were divided into three sections: (1) demographic survey, (2) integrative settlement questions and (3) social-psychological outcomes questions. We developed Likert scale survey questions for integrative settlement and social-psychological outcome. By using a 5-point Likert scale, survey questions were inherently more stable and subject to less random variability than single-item measures.

4.4. Participants

We recruited a total of 49 participants (male = 14 and female = 35). These 49 participants were likely to represent a diversity of background such as student (undergraduate = 10 and postgraduate = 5), community members = 4, and professional workers = 30. Community members and professional workers responded to emails that were sent to them. According to Compeau (2012), the approach " ... is to think critically about the aim of the study, the context of research, and the potential that they would have on the ability of the authors to meet their aims".

Table 2. Constructs and items measurement [20,36,40].

(Code) Construct	(Code) Items
(TA) Trust Ability	**(TA1)** The seller is competent.
	(TA2) The seller knows about the product.
	(TA3) The seller knows how to match the product/offer according to my preference.
	(TA4) The seller knows how to provide excellent service.
(TI) Trust Integrity	**(TI1)** Offers made by seller are likely to be reliable.
	(TI2) I do not doubt the honesty of seller.
	(TI3) I expect the seller will keep promises they make.
	(TI4) I expect the offer given by seller is their best judgment.
(IAO) Information Accept Offer	**(IAO1)** The seller knows how to ask information.
	(IAO2) The seller provides useful information.
	(IAO3) Offers made by seller are likely according to my preference.
(PNSNP) Perception of negotiation situation—negotiation process	**(PNSNP1)** Do you feel the seller listened to your wishes or preferences?
	(PNSNP2) Did the seller consider your wishes or preferences?
	(PNSNP3) How satisfied are you with the ease of reaching an agreement?
	(PNSNP4) Would you characterize the negotiation process as fair?
(PNSNO) Perception of negotiation situation—negotiation outcome	**(PNSNO1)** Did you feel like you forfeited or "lost in this negotiation?
	(PNSNO2) How satisfied are you with the result (outcome) of negotiation?
(POO) Perception of opponent—cooperativeness	**(POO1)** Did you feel the seller was helpful during the negotiation?
	(POO2) Did you feel the seller was flexible in making an offer?
	(POO3) How satisfied are you with the seller cooperativeness during the negotiation?
	(POO4) What kind of "overall" impression did the seller make on you?
(DFN) Desire for future negotiation	**(DFN1)** If there are needs in the future, would you willing to interact (e.g., subscribe newsletter) with the seller in future?
	(DSF2) If there are needs in the future, would you willing to negotiate with the seller in future?
(SR) Settlement Ratio	**(SR1)** Did you succeed in negotiation according to your preference or closed to your preference?

4.5. Procedures

The experiment was divided into three stages of procedures: pre-negotiation, during negotiation, and post-negotiation. In the pre-negotiation stage, participants were briefed about the general instructions and procedures of the experiment. The participant were also given the procedure guidelines for their reference. In the second stage of negotiation, the participants will negotiate with the automated negotiation agent until they reach an agreement or until the negotiation is terminated without an agreement, whereby the participants reject the automated negotiation agent's final offer. No time limit was imposed in this stage.

Last, the post-negotiation stage occurred upon completion of the negotiation task. During the post-negotiation, the participants were asked to complete the questionnaire reflecting on their responce

to integrative settlement and their post-negotiation (counterpart's social psychological outcomes). Demographic information was also collected for control checks.

5. Results

Hypothesis testing is the use of statistics to determine the probability that a given hypothesis is true. In this study, we used quantitative analysis to perform hypothesis testing. Quantitative methods emphasize objective measurement and the statistical, mathematical or numerical analysis data collected through various channels such as surveys, questionnaire or by manipulating pre-existing statistical data using computational techniques. By using a quantitative method, the research focus was on gathering numerical data and generalizing it across groups of people or to explain a particular phenomenon [51,52].

We used two analysis techniques for the hypothesis testing: (1) structural equation model (SEM) and (2) independent sample mean T-Test. For testing the effect of the integrative settlement (H1–H2), the results were submitted to the structural equation model (SEM) using SmartPLS. This becomes a good alternative when the sample size is small; SEM emphasizes the relationship between independent and dependent variables that are made up of latent variables. It is also known as causal modeling because it tests the proposal causal constructs. The details of the H1–H2 results are in the Results section.

A compared independent sample means T-test was used to analyze the second research model (H4–H6). The independent sample T-test compared two means of independent groups to decide whether there is statistical evidence that the associated population means are significantly different. The experimental design to test H4–H6 was within-group analysis. Within-group analysis, also known as repeated-measure, is a type of experiment design where all participants are exposed to every treatment or condition. The significant benefit of this type of experimental design is that it does not require a large pool of participants. It can also help to reduce errors associated with individual differences because each participant serves as his or her own baseline. The details of the H4–H6 results are in the Results section.

For success rate (H6), we used a mathematical formula to calculate the success ratio. The success rate is the fraction of percentage of success among a number of attempts. The formula is as follows:

$$\frac{Success_n}{Attempt_n} \times 100 \quad (1)$$

5.1. Demographic Analysis

Demographics are statistics about the population of particular geography that comprises an array of socioeconomic information such as gender, age, employment status, etc. [53]. In this study, we sought the forty-nine (49) participants likely to represent a diversity of background to align with the participant objectives. Therefore, we did the demographic survey and analyzed the input.

Table 3 demonstrates the results of demographic analysis. Thirty-five (35) participants are male and the remaining are female. The biggest distribution of participants' age is 18–24 for a total of 17. It was followed by a range of 25–34 for a total of 16 and 35–44 for a total of 11. The second lowest age distribution was over 45 with only 3 participants and the lowest was the under 18 with 1 participant. The highest dispersal was employed full time (total of 30). The second highest dispersal was student (total of 15). The rest were employed part time (total of 2), fresh graduate and self-employed (only 1 each). The final question in demographic survey was "is the participant the e-commerce user?". 37 participants answered "yes" and 12 "no". The purpose of this question was to identify the participant was familiar with the online purchase tools.

Table 3. Demographic analysis.

Item	Item (Frequency)
Gender	Male (35), Female (14)
Age	Under 18 (1), 18–24 (17), 25–34 (16), 35–44 (11), Over 45 (3)
Education	Bachelor's Degree (29), Diploma (4), High school Certificate (6), Master's degree (10)
Employment	Employed full time (30), Employed part time (2), Fresh graduate (1), Self-employed (1), Student (15)
E-commerce user	Yes (37), No (12)

5.2. Research Model 1—Integrative Settlement

The research model 1 (refer to Figure 1) was analyzed using SmartPLS (v.3.2.8), a partial least square structural equation modeling (PLS-SEM) tool [54]. It was a soft modeling approach to SEM with no assumption about data distribution [55]. Therefore, the tool is a good solution when a sample size is small [56–59]. It enabled the simulation analysis up to 200 indicator variables, allowing the examination of extensive interactions among moderator and latent predictor variable indicators.

Reliability results indicated that a few of the indicators needed to be removed due to outer loading number lower than recommended threshold value of 0.7 [60]. Therefore, to ensure the model reliability, we removed items TA2, T12, TI3, T14, IE1 and IS1. Then we reanalyzed the reliability and the results are given in Table 4. The outer loading number and the composite reliability exceeded the threshold. In additional, consistent with the guideline of Fornell and Larcker [60], the average variance extracted (AVE) for each measure exceeded.50, composite reliability (CR) exceeded 0.7 [61], and Cronbach's Alpha exceeded 0.7 [62]. Table 5 reports the discriminant validity of the measurement scale results. The elements in the matrix diagonals represent the square roots of the AVEs, which are greater in all cases that the off-diagonal elements in their corresponding row and column [60]. Therefore, it is supporting the discriminant validity of our scale.

Table 4. Reliability assessment of the measurement model.

Latent Variable	Indicators	Outer Loadings	Composite Reliability (CR)	Average Variance Extracted (AVE)	Cronbach's Alpha
Trust Ability	TA1	0.833	0.872	0.694	0.782
	TA3	0.793			
	TA4	0.870			
Trust Integrity	T11	1.000	1.000	1.000	1.0000
Information Accept Offer	IE2	0.906	0.878	0.783	
	IE3	0.864			
Integrative Settlement	IS2	1.000	1.000	1.000	1.000

Table 5. Discriminant validity (intercorrelations) of latent variable.

Latent Variable	Trust Ability	Trust Integrity	Information Exchange	Integrative Settlement
Trust Ability	**0.833**			
Trust Integrity	0.486	**1.000**		
Information Exchange	0.300	0.355	**0.885**	
Integrative Settlement	0.551	0.292	0.422	**1.000**

We tested convergent validity by extracting the factor cross loadings of all indicators to their respective latent constructs. Table 6 shows the result of convergent validity. The results indicate that all items loaded on their respective constructs, from a lower bound 0.70 to an upper 1.000, all greater than the acceptable threshold of 0.5. Thus, the convergent validity of these indicators as representing distinct latent constructs is confirmed.

Table 6. Convergent validity—factor loadings (bolded) and cross loadings.

	Trust Ability	Trust Integrity	Exchange Information	Integrative Settlement
TA1	**0.833**	0.443	0.264	0.481
TA3	**0.793**	0.325	0.169	0.361
TA4	**0.870**	0.430	0.297	0.512
TI1	0.486	**1.000**	0.335	0.292
IE2	0.238	0.298	**0.906**	0.403
IE3	0.300	0.296	**0.864**	0.339
IS2	0.551	0.292	0.422	**1.000**

Table 7 presents the hypothesis testing and the outcome on the relationship between trust and information exchange towards integrative settlement. One of the two trust elements, the ability has a statistically significant relationship towards integrative settlement with the path coefficient = 0.483, standard beta (sample mean) = 0.505, standard deviation = 0.145 and *t*-value = 3.331. However, for another element of trust, ability, it was found that the relationship between ability was towards integrative settlement.

Table 7. Description statistic and hypothesis testing.

Hypothesis	Relationship	Std Beta	Std Error	*t*-Value	Decision	95% CI LL	95% CI UL
H1a	Trust Ability -> Integrative Settlement	0.505	0.145	3.331 **	Significant	0.246	0.723
H1b	Trust Integrity -> Integrative Settlement	−0.074	0.149	0.269	Not Significant	−0.321	0.723
H2	Information Exchange -> Integrative Settlement	0.288	0.128	2.273 **	Significant	0.089	0.501

$n = 49$, ** $p < 0.001$.

The second variable that we manipulated to test its relationship with integrative settlement was information exchange. The finding shows that information exchange has a statistically significant relationship towards integrative settlement with the result of path coefficient = 0.290, standard beta (sample mean) = 0.288, standard deviation = 0.128 and *t*-value = 2.273). Figure 4 shows the results of the measurement model.

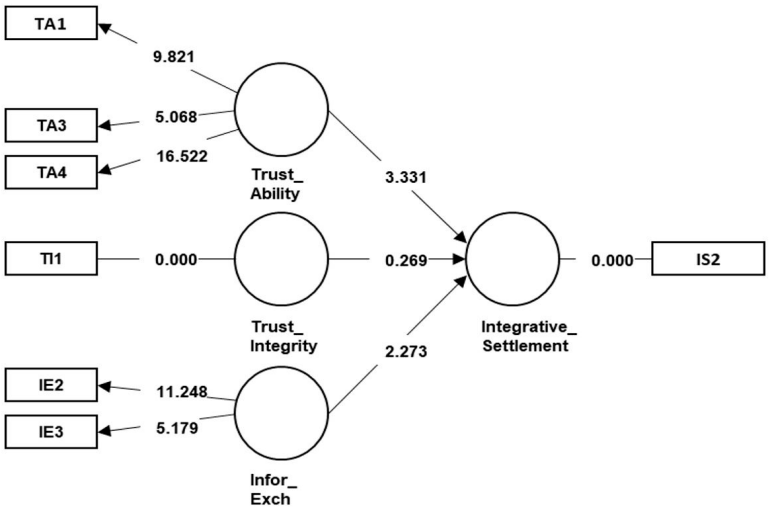

Figure 4. Measurement model result.

5.3. Research Model 2—Counterparts' Social Psychological Outcome

We checked the reliability analysis of the subjective independent variables before hypotheses testing analysis. We analyzed the question using SPSS reliability analysis, Cronbach's Alpha. It is commonly used to assess the internal consistency of a questionnaire that made up of multiple Likert-type scales and items. The result from the reliability analysis, Cronbach's Alpha, shows a current score $\alpha = 0.808$. However, we analyzed each of the items in the independent variable and found three items' score $\alpha > 0.808$. The items are PNSNO1 and DSF1 under MESOArgN treatment; and PSNNO1 under treatment SOArgN.

Therefore, we ignored four items for further hypotheses analysis. The remaining items have acceptable reliability with a Cronbach's alpha = <0.0875. The normality tests, Levene's Equality of Variance test were also conducted concurrently with the *t*-test analysis. A Levene's test verified the equality of variance in the samples (homogeneity of variance, $p > 0.05$) [63]. Therefore, the t-test result is enough for these hypotheses testing as the sample is a normal distribution.

An independent t-test was run of the data with a 95% confidence interval (CI) for the offer strategies (MESOArgN and SOArgN) mean difference. This test was to investigate the effects of offer strategies on the cpoo counterpart's social-psychological outcomes. It was found that after two interventions, the offer strategy MESOArgN were significantly higher than SOArgN. The human negotiators had great satisfaction with the negotiation process (H3a) when the agent negotiator was using MESOArgN strategy versus SOArgN strategy ($t = 9.808$ and $p < 0.001$). The result of H3b ($t = 6.968$ and p-value < 0.001) also confirmed that the human negotiator had greater satisfaction with the negotiation outcome when the agent negotiator used MESOArgN versus SOArgN as a negotiation offer strategy.

According to negotiation and marketing literature, the negotiators satisfied with the process and outcome and with a positive evaluation towards their counterpart's cooperativeness may lead to a desire for future negotiation [20,64]. The findings show H4 ($t = 8.821$ and p-value < 0.001) is statistically significant that the human negotiator had a higher perceived cooperativeness towards the agent negotiator when the agent negotiator was using MESOArgN strategy. As a result of H5 testing, ($t = 6.235$ and p-value < 0.001), it shows that the human negotiator's satisfaction with the negotiation process, negotiation outcome and cooperativeness with the agent negotiator was a highly encouraging connection with the desire for future negotiation. Table 8 shows a summary of the t-test finding.

Table 8. Descriptive Statistic and T-Test result of social-psychological perspective.

Hypothesis	Independent Variable	Mean (Standard Deviation)		t(df)	Sig. (2-Tailed)	Decision
		MESOArgN	SOArgN			
H3a	Negotiation process	3.7602 (0.48670)	2.7143 (0.56596)	9.808 **	0.000 *	Significant
H3b	Negotiation outcome	3.6327 (0.63554)	2.7143 (0.57735)	6.968 **	0.000 *	Significant
H4	Cooperativeness	3.6582 (0.52958)	2.6888 (0.55792)	8.821 **	0.000 *	Significant
H5	Desire for future negotiation	3.8163 (0.72668)	2.6936 (0.80891)	6.235 **	0.000 *	Significant

Notes $n = 49$, * $p < 0.05$, ** $p < 0.001$.

Overall, among agent-human negotiations of forty-nine (49) participants, thirty-nine (39) negotiations reached an integrative settlement and ten negotiations ended with no settlement for the MESOArgN strategy. Meanwhile, twenty-nine (29) agent-human negotiations reached the settlement and twenty (20) ended with no settlement for the SOArgN strategy. Table 9 shows that the success

rate is higher 79.59% when the agent used the MESOArgN strategy compared to SOArgN, where the success rate is 59.18% (refer to Table 9). Therefore, we concluded that H6 is statistically significant.

Table 9. Settlement ratio (success rate) result.

Hypothesis	Variable	Ratio (Percentage %)	
H6	Settlement ratio	MESOArgN = 79.59	SOArGN = 59.18
$n = 49$			

In addition, in all the hypotheses testing, we added one question on the human negotiator's preference. The results show forty-six (46) out of forty-nine (49) chose MESOArgN and the remaining chose SOArgN. We sought an explanation from participants that selected SOArgN as their strategy preference. Their response was it is difficult to select if given the multiple simultaneous options compared with the single option. Rather than selecting one of the options, they preferred to have a negotiation on the single item until reaching an agreement or settlement.

6. Conclusions, Research Implication and Future Work

6.1. Findings

McAllister (1995) defined trust as "an individual's belief and willingness to acct on the basis of the words, actions, and the decision of another". Trust is important in communications between human and agent. The meaning of trust in automation is the expectation of ability or competence of the agent or system to perform routine tasks [65]. It has a direct effect on willingness of humans to accept the input output such as produced information, suggestions and decisions from the agent [66,67] As suggested by Walton & Mckersie (1965) and Freedy et al. (2007), we found that the element of trust, specifically the ability (Hypothesis 1a) had a positive influence effect on the integrative settlement.

Besides the ability, trust collected several beliefs including integrity or honesty [41]. In this experiment, we found that the integrity (Hypothesis 2a) did not have a positive influence effect on the integrative settlement. This might be because of the human's dilemma of trust, which has to do with the degree to which the negotiator should believe the other party [68]. Trusting anything can prompt misuse or exploitation while trusting nothing makes it difficult to accomplish an agreement [68]. In other words, the less the human's trust in a software agent, they will intervene in the process to reach an agreement [66,69,70].

Information exchange was significant and a positive influence effect on the integrative settlement, supporting Hypothesis 2. In the integrative bargaining model by Walton and Mckersie (1991), information exchange is essential to make a precise judgment and reach an integrative settlement. Additionally, according to Walton and Mckersie (1991) "When information is low, the result will be less adequate definition of the problem; fewer alternatives will be generated; and the potential consequences of these alternatives will be generated; and the potential consequences of these alternatives will be less explored ... the parties will produce relatively low-grade solutions". Thus, the more information the human negotiators shared, the chances to reach an integrative settlement was higher [71,72].

Other than a significant positive influence on the integrative settlement aspects, the MESOArgN offer strategy was shown to have a significantly positive influence on the counterpart's social-psychological outcome. We tested four hypotheses (negotiation situation-process and outcome, opponent and desire for future negotiation) related to a counterpart's social-psychological outcomes. The results of the experiment confirmed that the proposed negotiation strategy, MESOArgN, enhanced the persuasiveness of an offer. The results also confirmed that the counterpart's satisfaction is higher compared with SOArgN. Negotiators who make multiple equivalent simultaneous offers discover more integrative solutions, attain more profitable results, and counterparts are favorable because of flexibility that comes with choices [73]. As expected, the settlement ratio (Hypothesis 6) of the MESOArgN offer strategy is higher than the SOArgN offer strategy. Based on the experiment results,

we feel there is an opportunity to employ MESOArgN strategy for human-agent negotiation into the real world of e-commerce facilitating a small size online transaction.

6.2. Implications

The experiment results have implications for negotiation theories, technological advancement and the practice in electronic marketplaces. The first implication for negotiation theories is understanding of multi-issue negotiations and the importance of information exchange to reach a win-win situation. The approach of multi-issue negotiations is to pack all the issues and discuss them concurrently as a complete package [74]. This situation could be complicated as overflow information. Therefore, it is crucial for both parties to trust each other so they have freedom to behave spontaneously without fear [12] in such sharing and exchange of information on their interest or preference.

This study presented an artifact for a software agent in agent-human negotiation. The objective was to reach a win-win situation for both parties. We deployed the artifact based on the design science research method, which is fundamentally a problem-solving paradigm [47]. In design science, the IS research cycle creates and evaluate IT artifacts [47]. According to Thompson (1991), a good negotiation strategy should be effective with the most uncooperative negotiators [75]. Therefore, in an evaluation of the artifact, we highlighted the importance of evaluating the effects of an agent in negotiation with a real human to ensure that the human feels satisfied with the process and outcome.

The final implication of this study is the artifact can be potentially deployed in real world e-commerce for the small business online transaction. The negotiation strategy that we configured into an agent is based on more realistic assumptions of negotiation setting. In previous studies, the negotiation strategy based on negotiation history data was manipulated using several mathematical and computing techniques such as probability and machine-learning [19,76–78]. Hence, the artifact can be used in open markets, which involve many-to-many relationships between seller and buyer where the prior negotiation knowledge or negotiation history data with the counterpart is not available to the agent.

6.3. Limitation and Future Research

Despite the significant implications, several limitations need to be highlighted as open avenues for future research. First, the proportion category of participants was not equal. Related to this limitation is the possible sample bias, the selection of a sample of other categories than student and community members. Consequently, the possible findings of this study only focused on one category. In the future, it would be better to have an equal proportion category of participants; hence, the findings will be comprehensive and convincing.

Second, this study did not include economic perspective as one of the measurements. Economic perspective can be measured using contemporary economic models of negotiation with emphasis on the prediction of optimal joint outcomes. The economists, game theorists and applied mathematicians frequently examine "utility" (an economic sense of satisfaction received by negotiators from the agreement) [20].

Third, this study did not consider the factors that determine the effects of the negotiation process. To comprehend how individuals judge if the behavior is right or wrong, researchers have examined a range of factors and relational constructs, for example, individual factors (personality) and their relationship to ethical judgment [79]. That examination proved the negotiation process could be more effective, and the researchers may have a better understanding of the negotiators' behavior.

Last, there was limitation communication on the chatbot. In this study, we emphasized the importance of exchanging information between both negotiators. This occurred during the negotiation and after negotiation, whereas the proposed offer by buyer is sent to admins of the webpage for their future analysis. This opens up new future research that implements an advanced artificial intelligence (AI) technology into the chatbot. The communication between buyer and seller could be established before the negotiation stage start. Therefore, the information about the buyer's interest or preference

can be directly obtained. As in the implication, it provides a chance for the seller to explore the buyer's interest or preference at a faster speed based on the preliminary information given at an early stage.

6.4. Conclusions

Negotiation is a fundamental element of organizations' social lives. It is a method for addressing problems and reaching a conclusion that benefits everyone engaged in the discussion. Negotiation can be divided into two categories; distribution negotiation and integrative negotiation. In this study, we focused on the integration negotiation, whereby taking in all parties' wants, needs, fears and concerns into the equation.

This study proposed a new offer strategy that combines two elements in negotiation; (1) tactic of multiple equivalent simultaneous offers, and (2) strategy of argumentation-based negotiation for an automated negotiation agent to reach an integrative settlement (win-win situation). Using a new offer strategy, we attempted to answer two questions: (1) "Does the approach of MESOArgN strategy enhance the persuasiveness of an offer?" and (2) "Will the approach of MESOArgN strategy enhance the negotiation outcome?". This study on negotiation strategy is not new to the negotiation field. Two factors in the model of negotiation measurements emerged; integrative settlement and social-psychological outcome.

We developed the prototype that configured the proposed offer strategy for hypotheses testing purposes. The prototype is an e-commerce site named compute2u.name.my that embarks software agent technology as a buyer. We programmed and configured the proposed offer strategy into the software agent for automated negotiation with humans. There were three main issues to be negotiated between agent and humans: price, warranty and delivery date. We also configured nine options for unit price, seven options for warranty and four options for delivery for hypotheses testing purposes. The combination of the value options for these three issues formed a total of one hundred eight (108) alternatives.

Incorporating the software agent technology (automated negotiation agent) into e-commerce is not envisioned to replace humans. Nonetheless, it can be an efficient decision support instrument for negotiations with humans [21]. Hence, such an agent can be used as a mediator for the negotiation processes and to reach an agreeable settlement, aiming to have a better negotiation.

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