Offer Strategy Model of Integrative Negotiation for Automated Negotiation Agent: Multiple Equivalent Simultaneous Offers and Argumentation-based Negotiation

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Research-in-Progress

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Abstract

Automated negotiation has attracted increasing interest and received phenomenal attention in the area of electronic market (e-market). Most of the studies on the automated negotiation focused on the distributive (zero-sum) negotiation, and their effectiveness is only illustrated in a single-issue negotiation between software agent-to-software agent interaction. In this study, we propose an offer strategy model of integrative negotiation for an automated negotiation agent and focus on software agent-to-human interaction. Our offer strategy model is based on the integrative approach and negotiation theory, which emphasize the importance of exchanging information among negotiators and multi-issue negotiation including package offers helping to achieve an integrative (win-win) outcome. In developing this model, we are incorporating negotiation strategy of argumentation-based negotiation and negotiation tactic of multiple equivalent simultaneous offers as an offer strategy to achieve an integrative (win-win) negotiation outcome. We expect that the result from applying the offer strategy model becomes more attractive and persuasive, thus may increase negotiation outcome satisfaction for both economic measure and social-psychological measure.

Keywords: Automated negotiation, software agent, integrative negotiation, argumentation-based negotiation, multiple equivalent simultaneous offers, offer strategy

Introduction

Negotiation is a pervasive activity and arises in areas of professional lives (e.g., business, government, non-profit organizations, legal proceedings, and nations) and private lives (e.g., parenting and everyday life) as well. Negotiation is defined as procedures for resolving opposing preferences between parties, which involves discussion between parties with the goal of reaching an agreement (Carnevale & Pruitt, 1992). Negotiations are complex phenomena that are evident from many different scientific disciplines that deal with negotiation problem from very different perspectives (Vetschera, 2013). It is often difficult for human negotiators to identify and make trade-off necessary to reach optimum outcomes due to their limited information processing capacity and capability, cognitive biases, and social-emotional obstacles (Yang, Singhal, & Xu, 2009). Hence, negotiation underwent a paradigm shift from the traditional method, such as face-to-face negotiation, to automated negotiation that implements artificial intelligence knowledge. Besides that, the paradigm shift was also due to the rapid growth of electronic markets (e-markets) requiring an enhancement entity that can assist human business decision-makers.

Automated negotiation is defined as a form of interaction in which a group of agents with conflicting interests and desire to cooperate comes to a mutually acceptable agreement on the division of scarce resources (Jennings et al., 2001; Rahwan et al., 2003). Agents are a group of software agents that perform certain tasks together. The software agent is a component of software and/or hardware that is capable of acting rigorously in order to accomplish tasks on behalf of its user (Nwana & Ndumu, 1998) and a self-contained program competent of analyzing its own decision making and reaction based on its own observation of the current environment in achieving one or more objectives (Jennings & Wooldridge, 1996). There are three key features of software agents that led to the implementation of automated negotiation; (1) they act on behalf of other entities in an autonomous fashion; (2) they are able to be reactive and proactive in deciding on undertaking an action; and (3) they exhibit some level of such capabilities as learning, co-operation and mobility (Kersten & Lai, 2010). The involvement of a software agent in automated negotiation can be distinguished into two types: (1) agent-to-agent negotiation, in which a software agent acts on behalf of one party and negotiates with another agent acting for the counterpart, and (2) agent-to-human negotiation, in which a software agent acts on behalf of one party and negotiation with a human counterpart (Yinping & Singhal, 2009).

Most of the studies on the automated negotiation focused on the distributive (zero-sum) negotiation, and their effectiveness is only illustrated in a single-issue negotiation (Yang et al., 2009). A single-issue negotiation is the negotiation situation with only one winner, whereby the negotiators will push for a settlement close to the counterparts' resistance point and claims the largest part of the settlement (Yang et al., 2009; Zeng & Sycara, 1998a, 1998b). In 2009, a study on the integrative negotiation for a software agent and human was conducted. The study examined the key strategic negotiation parameter on "what" offers can be proposed to strive the integrative negotiation (Yang et al., 2009). The negotiation parameter of "what" refers to the technique of the offer used in the negotiation strategy. They proposed a new negotiation strategy model, namely *multiple equivalent simultaneous offers and accepted with delay*. This model consists of two strategy techniques: (1) multiple equivalent simultaneous offers, which means making multiple offers that are mutually equivalent at each around, and (2) accepted with delay, which employs delay acceptance rather than immediate acceptance of a counteroffer (Yang et al., 2009). The result showed that the proposed negotiation strategy model worked effectively in achieving integrative negotiation for both economic and social-psychological outcomes (Yang et al., 2009). Despite such effort, designing the negotiation strategy for integrative negotiation still has room for improvement. The improvement that we are working on is how to enhance persuasiveness in offer-making to achieve integrative negotiation outcome, i.e., win-win negotiation settlement.

We aim at setting up a research agenda on an enhancement offer strategy model of the integrative negotiation. The offer strategy model is based on the multiple equivalent simultaneous offers of automated negotiation agent for software agent-to-human negotiation. According to social-psychological analysis, a negotiator can be more persistent and persuasive on the value of an offer using the multiple equivalent simultaneous offers technique (Yang et al., 2009). Therefore, we are interested in studying on the additional element that can be incorporated with multiple equivalent simultaneous offers, which make the offer more persuasive and attractive. Two research questions are proposed:

1) *How to make the argumentation to enhance the persuasiveness of an offer?*
2) *Will the approach of argumentation in multiple equivalent simultaneous offer strategy enhance the outcome of negotiation?*

We plan to implement the offer strategy model of integrative negotiation into the decision algorithms that are programmed in the automated negotiation agent. Then, we will do an experiment of the automated negotiation agent in the e-market environment and test its capabilities.

THEORETICAL BACKGROUND

The aim of integrative negotiation (also known as "non-zero-sum-game or win-win game") is to achieve a mutually beneficial agreement that maximizes settlement efficiency and fairness under appropriate conditions (Yang et al., 2009). Integrative approaches employ objective criteria to create the condition of mutual gain and emphasize the importance of exchanging information among the negotiators (Alfredson & Cungu, 2008). The notable contribution of integrative negotiation was described by Walton and McKersie. According to them, this is a negotiation approach in which negotiators employ problem-solving behavior (Walton & McKersie, 1965) that refers to a state of desire for finding a solution to the problem to reach a definite goal. Phase theory in the integrative school views the negotiation process as qualitatively distinct sub-process (phases) that sets the texture, momentum, and potential of the negotiation (Alfredson & Cungu, 2008).

The basic concepts of negotiation are *strategy*, *tactics*, *reservation point or bottom line,* and *Zone of Agreement* or *Zone of Possible Agreement (ZOPA)*. Strategy is a careful plan or method, especially for achieving the negotiation goal. Meanwhile, tactic is referred to as the skill of using available means to reach the negotiation goal (Alfredson & Cungu, 2008). For example, in the distribution strategy negotiation, the negotiator may use the coercion[1], opening strong[2] or salami tactic[3] as their tactics to achieve a desired negotiation outcome. Reservation point or bottom line is a point beyond which the negotiator will not go and instead breaks off the negotiation. A ZOPA is an overlap between the maximum purchase the buyer is willing to make and the minimum sale price that the seller is willing to accept (Alfredson & Cungu, 2008). When ZOPA exists, there is a possibility that the negotiation may come to a mutually acceptable agreement.

The *social influence* is a topic that has been researched in social-psychology field. *Social influence* occurs when the behavior by a person has the effect or even just the intention of changing another person's behaviors, emotions, or opinion about a stimulus (Zimbardo & Leippe, 1991). *Social influence* acts as an umbrella term for *persuasion*. *Persuasion* consists of four essential elements: (1) establishing credibility, (2) framing/argumentation to find common ground, (3) providing vivid evidence, and (4) connecting emotionally (Conger, 1998; Petty, Cacioppo, & Goldman, 1981). *Social influence* through persuasion is more likely to be successful to satisfying wants and needs for everyone (Brinol & Petty, 2009). The social-psychology analysis showed that a negotiator could be more persistent and persuasive regarding a value of an offer by using multiple equivalent simultaneous offer strategy (Thompson, 1990; Yang et al., 2009). Framing/argumentation is one of the essential elements of persuasion; therefore, it would be motivating to integrate argumentation-based negotiation into the proposed offer strategy. On the other hand, the values of an offer can be more attractive. Underpinned by the *social influence*, the context of our research model is described below in concerning (1) argumentation-based negotiation, (2) multiple equivalent simultaneous offers as an offer strategy and (3) best alternative to an agreement as an offer strategy. We then describe how our expectation of negotiation outcome changes when the software agent makes that offer strategy.

Offer Strategy

An offer strategy is a plan of action connected to the decision of a negotiator in making offers. To achieve the integrative negotiation outcome, we propose an offer strategy model that incorporates two elements in negotiation: (1) strategy - argumentation-based negotiation and (2) tactic - multiple equivalent simultaneous offers technique. Furthermore, for reservation point, we use the Best

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[1] Using force, or the threat of force to wrestle concession from an opponent (Saner, 2000)
[2] Starting out with a position that is higher than what you realistically estimate you can achieve (Saner, 2000)
[3] Prolonging a negotiation to a painstakingly slow pace, only giving a very small concession to the other side when it can no longer be avoided in order to placate the other side for a little while longer (Saner, 2000)

Alternative to a Negotiated Agreement (BATNA) which is a parameter to be used in the experiment. The offer strategy model is based on the integrative approach and negotiation theory, which emphasize the importance of exchanging information among negotiators (Alfredson & Cungu, 2008) and multi-issue negotiation including package offers helping to achieve an integrative (win-win) outcome (Husted Medvec, Leonardelli, Galinsky, & Claussen-Schulz, 2005).

Argumentation-based Negotiation (ABN)

Argumentation theory is the interdisciplinary study of how deductions can be reached across logical reasoning. The logical reasoning is based on claim, sound or not, and on premises[4]. It includes the arts and science of civil debate, persuasion, dialogue, and conversation (Van Eemeren & Grootendorst, 2004). Arguments constitute the major part of real-life negotiations on personal matter (e.g., a fight between family members over which TV channel to watch), up to business deal (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 allow an agent to justify its negotiation standpoint and influence another agent's negotiation standpoint (Rahwan et al., 2003). For example, in trade union dispute, an agent representing the workers' union might refuse an offer for a modified pension plan by the organization's management; as a response, the management agent might offer a different pension plan (Rahwan et al., 2003) to persuade a workers' agent to have win-win settlement because the agent can accept, reject or critique the offer. Two aspects make it necessary to incorporate arguments into the negotiation model: (1) argumentation is a tool in the negotiation for the agent to gather information and disclose information strategically to adjust its utility functions and to update its beliefs about counterpart (Lopes et al., 2014), and (2) in reality, agent frequently has limited (as opposed to zero or full) knowledge of its opponent, and argumentation is used by an agent to exchange information strategically (Lopes et al., 2014).

Multiple Equivalent Simultaneous Offers (MESO)

The multiple equivalent simultaneous offers (MESO) technique was proposed as an alternative to basic strategy – a sequential-single offer[5]. The MESO technique allows a negotiator to make multiple offers which are mutually equivalent at each round. For example, a software vendor presents three similar software packages to a client simultaneously: $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 research have revealed that multi-issue negotiation including package offers is superior in achieving integrative outcome (Husted Medvec et al., 2005). Prior studies have shown that people who highly value choice preferred multiple options rather than having a single alternative (Iyengar & Lepper, 2000) and suggested that integrative benefits can be achieved when both sides are using MESO (Husted Medvec et al., 2005). Furthermore, an experiment of human-to-human negotiation showed that MESO technique had better acceptance rate and improved opponent's satisfaction towards the offer (Husted Medvec et al., 2005; Yang et al., 2009).

Best Alternative to a Negotiated Agreement

The objectives in any methods of negotiation are to protect the negotiator against making an agreement that they should reject and to help them make the most of the assets they have so that any agreements reached will satisfy negotiators' interests as far as possible (Fisher, Ury, & Patton, 2011). To achieve this objective, Fisher and Ury from the Harvard Program on Negotiation (PON) have developed a guideline called Best Alternative to a Negotiated Agreement (BATNA) (Fisher et al., 2011). BATNA provides negotiators with measures of flexibility where the negotiation can continue even when the desired settlements are rejected because the negotiators are freer to continue to explore additional possible solutions (Alfredson & Cungu, 2008). BATNA needs to be assessed and developed before and during the negotiation process. Therefore, it is crucial for negotiators to know their BATNA before and throughout all stages of a negotiation. Fisher and Ury list three distinct operations to generate the possible BATNA (Fisher et al., 2011). These are inventing a list of actions the negotiator might conceivably take if no agreement is reached; improving some of the most promising ideas and converting them into practical alternatives; and selecting, tentatively, one option that seems the best

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[4] A premise is an assumption that something is true (The Cambridge Dictionary of Philosophy, 2nd Edition).
[5] An offer strategy when a negotiator adopts a concession-based approach by starting with a tough offer, and concedes by making by offers of a lower self-utility sequentially in subsequent rounds (Yang et al., 2009)

(Fisher et al., 2011). Integrative negotiation is viewed as a joint decision-making process. Therefore, there is always a possibility of the negotiators reconsidering their position in mid-stream and deciding to pursue a different course from the one initially planned.

Negotiation Outcome

The objective of negotiations is to reach an outcome that satisfies both parties. Negotiation outcomes can be measured by two categories: *economic measure* – generally, the actual allocation of negotiated resources that result from the negotiation encounter, and *social psychological measure* – the subjective social perceptions held by negotiating parties following the encounter (Oliver, Balakrishnan, & Barry, 1994; Thompson, 1990).

Economic Measures

The economic measure assesses the actual allocation of negotiated resources based on the efficiency. Normally, negotiation outcomes are summed to form a measure of joint efficiency (Thompson, 1990). *Joint efficiency* refers to the extent to which the negotiators' joint payoff approaches to frontier (Yang et al., 2009). The basic theory to measure the joint efficiency is Pareto Efficiency. Pareto Efficiency, also known as Pareto Optimal, is a state of allocation of resources further from which it is impossible to make any negotiator better off without making another negotiator worse off. Joint efficiency can be measured by calculating the distance from the settlement point to the Pareto Optimal agreement (Tripp & Sondak, 1992). The smaller the Pareto Efficiency distance is, the better the process efficiency is. By using the proposed offer strategy, we propose the following hypothesis:

H1: *Compared to MESO, the joint efficiency will be improved (Pareto Efficiency distance is smaller) when the software agent makes MESO with ABN.*

Another variable that is used in economic measures is the settlement ratio. *Settlement ratio* refers to the number of successful or unsuccessful negotiation cases over the total number of negotiation cases (Tripp & Sondak, 1992). The higher success rate of settlement ratio is the better the process efficiency is. By using the proposed offer strategy, we propose the following hypothesis:

H2: *Compared to MESO, the settlement ratio (success rate) will be higher when the software agent makes MESO with ABN.*

Social-Psychological Measures

Social-psychological measures the negotiation performance based on social perception concept that includes most aspects of perceivers' social worlds: people, their behaviors, and situation (Thompson, 1990). *Perception of negotiation situation* refers to a negotiator's judgments on the negotiation process and outcome, such as his/her judgment of the fairness of the process and outcome of negotiation. It also includes the view of the negotiation structure task: purely competitive, cooperative or integrative (Thompson, 1990). *Perception of other party* refers to a negotiator's judgment towards his/her negotiation opponent, such as intelligence, sociability, expertise, skill, ability, cooperativeness, and competitiveness of his/her opponent (Thompson, 1990). By using the proposed offer strategy, we posit the following hypotheses:

H3: *Compared to MESO, the human negotiator has a greater satisfaction with the negotiation process and outcome when the software agent makes MESO and ABN.*

H4: *Compared to MESO, the human negotiator has a higher perceived cooperativeness towards the software agent when the software agent makes MESO and ABN.*

The *desire for future negotiation* refers to the negotiator's subject evaluation on the perception of negotiation situation and the perception of the other party. Satisfaction with current negotiation situation may influence the negotiator to work together in the future. By using the proposed offer strategy, we expect this following hypothesis:

H5: *The human negotiator's satisfaction with the negotiation process and outcome as well as the perceived cooperativeness of the software agent is encouragingly connected with the desire for future negotiation.*

RESEARCH METHODOLOGY

This study implements a design science research method. Design is a problem-solving paradigm that seeks to create innovation, 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 (Hevner et al., 2004). Design science research in Information Systems must produce an artifact in the form of either construct, model, method, or instantiation (Hevner et al., 2004). The research approach in this study consist of two methods:

1. Prototype/IT artifact - We will develop the negotiation interface as IT artifact. Besides that, we will also develop a decision algorithm that is programmed in the automated negotiation agent for the software agent-to-human negotiation. The software agent represents the seller, and the human is the buyer. The development of IT artifact is to answer our first research question.

2. Laboratory experiment- A 2x2 experimental study will be designed to test the hypotheses. The experiment is divided into three stages of procedures. The three stages are pre-negotiation, during negotiation, and post-negotiation. In the pre-negotiation stage, participants will be briefed about the general instructions and procedure of the experiment. In the second stage, the negotiation stage, 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. Lastly, the post-negotiation stage occurs upon completion of the negotiation task. Participants are asked to record the negotiation settlement. During the post-negotiation, the participants are required to complete the questionnaire reflecting on their social perceptions held by negotiating parties following the encounter. This experiment is to answer our second research question.

CONCLUSION

Expected Contribution

This study attempts to extend the previous study on multiple equivalent simultaneous offers as an offer strategy for the automated negotiation agent to achieve an integrative negotiation outcome. In developing an offer strategy model of integrative negotiation, we propose to use the multiple equivalent simultaneous offers as a negotiation tactic and argumentation-based negotiation as a negotiation strategy. The previous study demonstrated that the negotiation tactic of multiple equivalent simultaneous offer is effective in achieving an integrative negotiation outcome. The aim of this study is to integrate the argumentation-based negotiation with multiple equivalents simultaneous offer technique. Consequently, the offer becomes more attractive and may increase negotiation satisfaction both economically (joint efficiency and settlement ration), and from the social physiology perspective (perception to negotiation situation, perception of other party and desire for future negotiation) as well. It supports the objective of integrative negotiation, which focuses on problem solving, value creation, and communication.

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