

Experiments in Human Multi-Issue Negotiation: Analysis and Support (extended abstract) ¹

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Negotiation is a process by which a joint decision is made by two or more parties [1]. Typically one of the parties starts a negotiation by offering the most preferred solution from the individual area of interest. If an offer is not acceptable to the other parties they make counter-offers in order to move them closer to an agreement. Multi-issue negotiation (also called multi-attribute negotiation) is often seen as a more cooperative form of negotiation than single-issue negotiation, since often an outcome exists that brings joint gains for both parties, see [2].

The first purpose of this paper is to present a System for Analysis of Multi-Issue Negotiation (SAMIN). SAMIN is designed to analyse negotiation processes between human negotiators, between human and software agents, and between software agents. Basically, the system needs three different inputs:

- (1) a negotiation *trace* (or a set of traces)
- (2) a set of *dynamic properties* that are considered relevant for the negotiation process
- (3) the *negotiation profiles* of the participants

A *trace* is a sequence of bids by the negotiators. A *dynamic property* is an (informal, semi-formal or formal) expression that can or cannot hold for a certain trace. An example of a simple dynamic property is bid-alternation, i.e., after communicating a bid to another agent, the agent remains silent

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until it has received a new bid from the other agent. A *negotiation profile* is a description of the preferences of the agent within the particular negotiation domain. The profiles together define the space of possible and efficient outcomes and are, therefore, essential for the creation of a complete analysis of the performance of a negotiator. SAMIN can check automatically whether selected properties hold for the traces under analysis. Such an analysis provides a means to improve bidding strategies and bidding protocols, both for human negotiators and for software agents in automated negotiation systems.

The second purpose of the paper is to present the results of using SAMIN to analyse empirical traces obtained from 74 people negotiating with each other in pairs. The multi-issue negotiation concerned second hand cars. SAMIN proved to be a valuable tool to check the dynamics of human-human closed negotiation against a number of dynamic properties. Our analysis shows that humans find it difficult to guess where the Pareto Efficient Frontier is located, making it difficult for them to accept a proposal. The Pareto Efficient Frontier is the set of bids, such for each bid in the set there is no alternative bid that is better for both parties, for further info the reader is referred to [2]. Although humans apparently do not negotiate in a strictly Pareto-monotonous way, when considering larger intervals, a weak monotony can be discovered. The results of such an analysis are useful in two ways: to train people in negotiation, and/or to improve the strategies of software agents. Amongst our plans for future research are:

- to analyse the dynamics of expert human negotiators
- to analyse the dynamics of automated negotiation systems
- to test the effectiveness of training methods for negotiation
- to extend SAMIN to provide feedback to a negotiator during a negotiation, where SAMIN only has access to the same information as the negotiator. Note that for a thorough analysis of a negotiation, the systems needs the profiles of both negotiators.

References

- [1] Pruitt, D.G., *Negotiation Behavior*, Academic Press, 1981.
- [2] Raiffa, H., *Lectures on Negotiation Analysis*, PON Books, Program on Negotiation at Harvard Law School, 513 Pound Hall, Harvard Law School, Cambridge, Mass. 02138, 1996.