Gert-Jan de Vreede (Editor)

Group Decision and Negotiation 2010

Proceedings of the 11th Group Decision & Negotiation Conference
Delft, The Netherlands, 21-23 June 2010

Group Decision & Negotiation 2010 is organized by:

TU Delft
Delft University of Technology

University of Nebraska Omaha

The Center for Collaboration Science

Colofon

Published by:

The Center for Collaboration Science
University of Nebraska at Omaha
6001 Dodge Street
Omaha, NE 68182

Phone: (402) 554-3010

The organizers acknowledge the support from the Netherlands Research School for Information and Knowledge Systems (SIKS), Delft University of Technology, and the University of Nebraska at Omaha.

ISBN 9789056382360

Printed in the Netherlands

Analytical Concession-Advisor Technology (ac-at)

Rudolf Vetschera[1], Michael Filzmoser[2], and Ronald Mitterhofer[2]

[1]University of Vienna, Department of Business Administration, Bruenner Strasse 72, 1210 Vienna, Austria
[2]Vienna University of Technology, Institute of Management Science, Theresianumgasse 27, 1040 Vienna, Austria

rudolf.vetschera@univie.ac.at, michael.filzmoser@tuwien.ac.at, ronald.mitterhofer@tuwien.ac.at

Keywords: Negotiation, concession, analytical advice.

Disputants in negotiations often fail to reach agreements at all or settle for inefficient agreements. Though negotiation support systems (NSS) provide post-settlement procedures to find Pareto-improvements for tentative agreements, these procedures are only applicable once an initial agreement was found and lack acceptance. Most NSS also do not provide active support in the sense that they guide parties along a specific path towards an agreement. Analytical bargaining models, which describe such processes leading to efficient solutions, are often formulated as models in utility space only and thus cannot directly be applied to actual negotiations, where parties make offers in issue space and not in utility space. Furthermore, these models often describe only one single path leading to a normatively prescribed solution, and therefore leave no room to control the process for individual negotiators. This lack of user control greatly diminishes their acceptability as support tools.

Our research aims to bridge the gap between normative process models and negotiation support by (i) proposing a generic model of a concession path, which still leaves considerable room for control by negotiators, and (ii) developing methods that allow to translate a concession path in utility space into specific offers in terms of the actual issues being negotiated.

This concession making model supports the progress in negotiation, to increase the prospect of reaching an agreement, and simultaneously reduces the distance to the Pareto-frontier, to increase the efficiency of reached agreements. It describes concessions along a path which fulfills the following properties:

- Each step consists of a real concession, i.e. the negotiator proposing an offer accepts a decrease in own utility.
- Each step is value-increasing in terms of total utility, i.e. the utility decrease to the negotiator making the offer is more than offset by an utility increase to the opponent.
- It implements the fairness norm that received concessions should be reciprocated, therefore each concession has at least to match the previous concession of the opponent.
- The actual trade-off between reduction in the negotiator's own utility and gain to the opponent can be controlled by the negotiator, which allows to choose among different concession paths.

When we consider a step in the bargaining process with respect to negotiator 1 and assume the last offer sent by this negotiator has led to utility values $u^0=(u_1^0,u_2^0)$ these requirements can be formalized as follows:

A real and value-increasing concessions is defined by the following conditions:

$$\begin{aligned} u_1 &\leq u_1^0 \\ u_2 &\geq u_2^0 \\ u_1 + u_2 &\geq u_1^0 + u_2^0 \end{aligned} \tag{1}$$

Furthermore this real and value-increasing concession at least has to reciprocate the opponents last concession ***d***:

$$u_2 \geq u_2^0 + d \tag{2}$$

possible concession paths then are described by a cone, which begins at (u_1^0,u_2^0) and is bounded by the two lines :

$$\begin{aligned} u_1 + (\alpha - \tau)\, u_2 &\leq u_1^0 + (\alpha - \tau)\, u_2^0 \\ u_1 + (\alpha + \tau)\, u_2 &\geq u_1^0 + (\alpha + \tau)\, u_2^0 \end{aligned} \tag{3}$$

Where α is a parameter which describes the direction of the cone, i.e. the trade-off between own utility and opponent's utility that a negotiator is willing to accept, τ is a parameter (possibly defined in the NSS) which describes how far actual concessions might deviate from the path defined by α, and $0 \leq \alpha \pm \tau \leq 1$.

This model describes the desired outcomes of a concession in terms of a vector of utilities. A given utility vector, however, can probably be implemented by different issue values. To support the user in choosing among these potential offers, we propose models which generate offers that provide the desired utility values and are as similar as possible to a reference offer. This reference offer either can be the last offer of the negotiator, the last offer of the opponent, or a combination of both. For offer generation the model applies an augmented Tchebycheff norm to measure distances in issue space, which enables the implementation as a linear program for the case of continuous issues and linear utility functions. We also show how the problem can be formulated as a mixed-integer linear program for the case of continuous issues and piecewise linear utility functions, and for the case of issues for which only discrete values are possible.

We propose two different approaches for the implementation of the concession making model in NSS. A passive approach evaluates proposals considered by the negotiator and provides information on the fulfillment of the model's constraints and similarity in configuration of offers. The second and more proactive approach uses the information about the negotiator's concerns for his own and the opponent's outcome α and the concession size necessary to reciprocate the previous concession of the opponent d to determine a specific utility vector in the permitted area and proposes an offer in terms of issue values to implement these utility values. The application of the model is demonstrated by a numerical example using Raiffa's 'Nelson vs. Amstore' negotiation case.