

Negotiation Supported Through Visualization Methods

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Abstract. Advanced information technology provides the basis for continuous monitoring of main negotiation data. On the whole, conflict situations appear when there are uncertainties about negotiators' interests and sometimes they do not exactly know what to do. To support the decision process for negotiation settings, a new dynamic approach is proposed. Visualization methods can be used to show negotiation information through crossing data reports and graphics. Then, it is the aim of this paper to present a tool to structure the negotiation through visualization methods. In this work, a group of visual reports is shown to provide a diagnosis to quicker understand the negotiation and, consequently, to improve the chances of an agreement.

1 Introduction

Isolated initiatives, without adequate preparation can unexpectedly lead a promising business to failure. It is not rare to find, even among experienced negotiators, failures caused by the lack of preparation and by negligence of risks [1].

These disregards often result in gaps or dichotomies of information in the negotiation table and, in each round, the volume of information to be understood becomes an attenuating.

It has long been known that people's cognitive abilities are limited in the simultaneous processing of a high amount of information [2]. Therefore, it is the negotiator's responsibility to determine what the most important information to be used on negotiation table is once it is impossible to memorize all negotiation variables.

Moreover, it is also known that the cognitive system is slow if compared to the perceptual system, especially the visual. The use of visualizations during data analysis enables information aggregation and, consequently, enhances cognition once it allows people to observe thoroughly and identify patterns, bringing up information that would be difficult to analyze and to understand [3].

According to [4], a number of visual features such as motion, color, intensity, size, intersection, closure, orientation, lighting direction, and distance from the observer may be extracted "preattentively" without conscious effort and within 100-200 milliseconds. However, it could take between hundreds of milliseconds and a few minutes

to understand the cognition of the same amount of information without the support of visual clues [5].

In this context, this work proposes a tool to support the negotiation decision making process, aiming at facilitating the negotiator's knowledge acquisition through a group of suggestive synthetic reports, which were developed through visualization methods. Besides, this article shows examples of different negotiation contexts, in which specific reports are recommended to support negotiator in each illustrated situation.

2 The Negotiation Process

As well as in the quotidian organization, the rapport between individuals is permeated with situations involving negotiations. It is common to live circumstances in which, intuitively, people create new relationships which often results in opportunities to make coexistent relations or business agreements.

Based on planned or unexpected events, a good negotiator must have the inherent capacity to find opportunities. Once the ability to reach agreements is commonly acquired over time, experienced negotiators have, theoretically, more chances to be successful [6]. This often occurs because the experienced negotiator is quick at discovering the main points of conflict as well as the interests of each party.

In general, negotiation is an activity that requires training, practice, coaching, strategy, preparation and allows the execution of agreements that are mutually acceptable for counterparts, even though different conflicts may occur and external help may be needed [7].

According to [8], a conflict can be defined as a concurrent situation in which counterparts are aware of future incompatibilities related to potential positions. In this case, a conflict occurs when one party takes an incompatible position in relation to the other counterpart's desires. Overall, the main points of conflicts are scope, time, cost, quality and management resources [9].

It is important to emphasize that the negotiations can be divided into phases. As stated in [10], there are four stages in a negotiation process: preparation, value creation, value division and execution.

Preparation is the phase in which negotiators should point out their positions clearly and try to comprehend the counterparts' relationship [7] in addition to define the BATNA (Best Alternative To a Negotiated Agreement). BATNA concept is used to assist negotiators to keep the focus on the objective and to present different ways of achieving the planned interests [11].

Besides, in the preparation step, the negotiator should define the ZOPA (Zone of Possible Agreement), or simply zone of potential agreements, which involves the counterparts' satisfaction range [12]. Cultural aspects [13] and elaboration of mutual gain suggestions [14] should also be taken into consideration in the ZOPA.

In the Value Creation step, it is important to continue exploring the counterpart's interests and generating alternatives that extend mutual gains [15]. At this stage, it is

important to avoid the criticism and encourage the use of neutrality to facilitate the relationships and to enable the creation without prior commitments.

The Value Division is a step to propose contingent agreements and to project future agreements [10]. At this stage, it is necessary the use of neutrality to suggest possible ways of distribution and discuss standards and criteria for distributing the generated value [15][16].

Finally, the Execution step must establish arrangements to keep track or check adopted decisions and facilitate the commitments maintenance. At this stage, incentives and organizational controls must be aligned and it is essential that the negotiator work continuously so as to improve relationships and take an unbiased position to resolve disagreements [10][17].

Among these 4 phases, Preparation step is the most important one once it gathers enough information to facilitate agreement, define the problem and to find out the counterparties' interests clearly. Great negotiators have already said that this step is the key to success in negotiations [18][19][20][1] because it prevents the consolidation of counterparts' inflexible positions and focuses on the main interests of the involved parties [21][22].

It is important to highlight that there are similarities in the best practices used by the major negotiators [23], thus, it is possible to imagine a group of negotiation reports and interfaces, based on best practices, which supports even inexperienced negotiators.

These aspects indicate that it is necessary to organize the negotiation in systematic steps and provide reports to contextualize negotiation faster. This approach can also be used in moments when the negotiator substitution is needed. During negotiations, the turnover of professionals is common and the lack of information is the most attenuate factor to maintain the negotiation productivity.

This work aims at presenting a viable alternative to structure the negotiation through visualization methods. In this context, a group of visual reports is shown to provide a diagnosis to quicker understand the negotiation and, consequently, to improve the chances of an agreement.

3 Visualization Methods

Although information exploration should be a pleasant experience, many researchers alert to information overload and the anxiety it causes [24]. Nowadays, interface designers are developing powerful methods for information research and visualization, trying to provide better technology integration to this task.

According to [25], Information Visualization is the use of visual representation, interactive and supported by computer and abstract data to improve cognition. The visualization of abstract data allows scientists to use their perception to see a phenomenon in data, reducing the cognitive effort.

However, in order to obtain a successful visual representation of data, it is necessary to preserve its mapping. In [25], it is suggested a reference model to map data in visual ways, as seen in **Fig. 1**. In this model, the first transformation works with raw

data and is stored in data tables. The second step is the choice of a visual structure (lineal, map, tri-dimensional, temporal, tree-like, etc.) which best represents the stored data. The last step consists in visual transformations, which are the possible interactions a user can produce on visual structures and, consequently, obtain different visions from them.

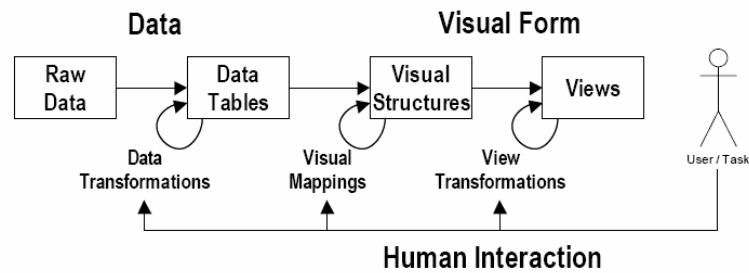


Fig. 1 Reference model for visualization (based on [25])

According to the task that is being performed, it is the user who makes all the changes cited in the model. The human interaction with visual structures and their parameters of mapping create a workspace of information which results in the development of a visual sense. This space reveals information properties making new choices possible.

The developed techniques for information visualization involve kinds of data representation (2D, 3D, trees), human interaction (dynamic queries, direct manipulation) and tasks (general vision, zoom, filter, etc.). Without using techniques to represent data graphically, it is more difficult to be aware of countless important aspects, such as tendency, differences, proximity, relevance, amount etc.

4 Visual Negotiator

Visual Negotiator is an environment composed of tools to support negotiators. In this software, there are some reports which accelerate the negotiation comprehension through visualization methods. This section aims to present the main statements interfaces.

As illustrated in **Fig. 2**, the software is distributed in four modules: NKM, NRM, NTM and NVM. NKM is a system to support the Negotiation Knowledge Management; NRM is a tool to manage Risk in Negotiations; NTM has some routines to mine negotiation data and NVM is a module which has a group of reports that use Visualization Methods.

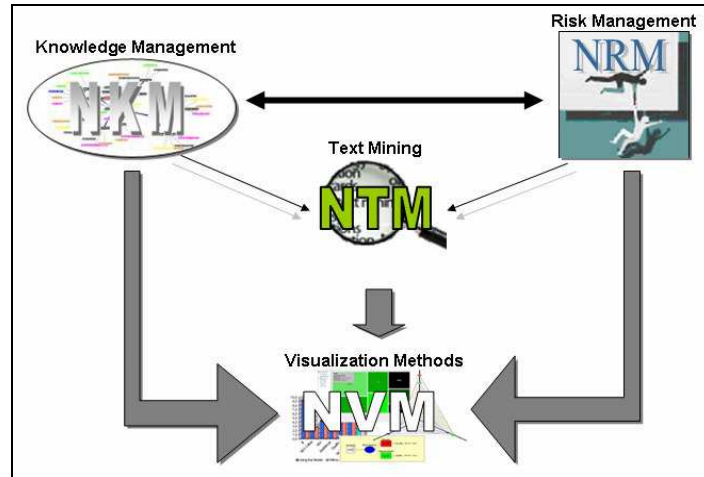


Fig. 2 Modules of Visual Negotiator

First, it is necessary to store basic negotiation data, such as client, goals, stakeholders and BATNA in the NKM module. From the list of objectives, risk management is done and, based on the survey on potential risks, the proposed software suggests some measurement parameters to evaluate threats and opportunities as well as reaction priority for each risk. Risk management takes place in the NRM module and if there is enough data on the process, at any time, the software can cross the negotiation data through text mining techniques in the NTM module. Finally, NVM module contains a group of visual reports and gives negotiators subsidies to highlight possible ways to increase the chances of agreement.

The utilization of visualization methods provides high degrees of usability, especially to show the prioritized negotiation data. In the NKM module, for example, the user is invited to fill in some forms to keep the negotiation's preparation data up-to-date. Based on the stored records and through visualization methods, the software can exhibit different types of graphics.

One example of visual report is the radar interface, illustrated in Fig. 3. This interface is gradually mounted from the inference of stored negotiation variables data. The radar takes into account the number of items extracted from the mining of each negotiation element as well as if there were defined contents. The volume of collected information is compared to each negotiation element and the software calculates the average value to shape the graph.

The applied text mining techniques use free texts stored by negotiators as the input. These data are collected during negotiations, especially in preparation stage. The tool user can store negotiation's information such as context, interests, options, costs, concessions, aspects of power and compliance, the influence of time and the professionals involved.

Concerning the previously identified items, the system uses a visual mechanism to show negotiators what was corroborated by the counterparties. When a negotiator

states that an item may be available for share viewing, the system generates reports of common understanding. The so-called public reports, exemplified in **Fig. 3**, are used to confirm counterparties agreements and the approved artifacts are then posted on the drawing board.

In addition, visualization concepts can be observed in the thermometers of rationality, emotion and satisfaction. These graphic representations reflect the negotiator's point of view allied to statistics formed by checklists answered by counterparties. In the negotiations, these indicators may seem subjective but should be focused on because they indicate the negotiator's perception related to common sense, as shown in **Fig. 3**.

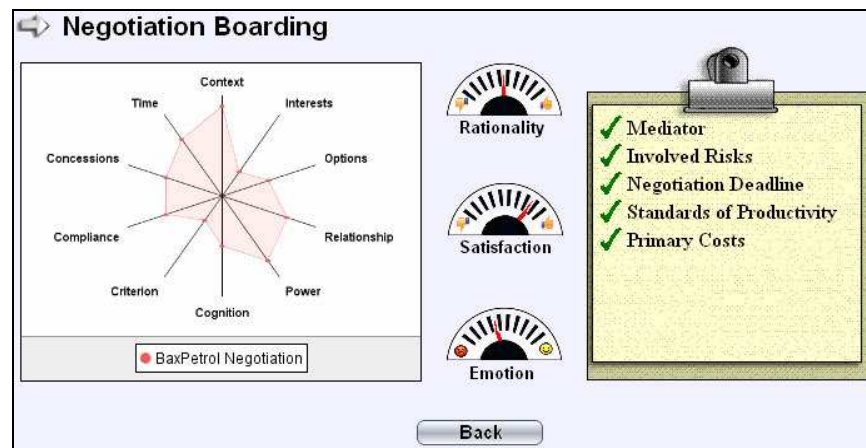


Fig. 3 Radar graphic report

It is important to emphasize that Visual Negotiator also uses text mining technology to manipulate old negotiations and attempt to discover similarities among them. The database employs XML to store and to do the interoperability among negotiations. Therefore, visualization methods are applied to increase the usability and stimulate negotiators to fill the interfaces and, subsequently, to obtain the reports.

The interoperability is significant because there are distinct modules in the negotiation environment; hence, XML is used to connect the system's components and to avoid duplicate data, for example.

In **Fig. 4**, it is possible to see an example of a report which joins information of distinct modules. On the left-side superior, **Fig. 4** shows counterparties' ongoing concessions until the agreement. This chart points out the concession's way of each negotiation part and signalizes if the agreement was well-adjusted.

At this level, negotiators can also analyze if they paid careful attention to potential risks. Furthermore, negotiation can be more productive if risks are considered not only as threats but also as opportunities [9]. Negative risks can lead the negotiation to failure while positives risks may increase the chances of succeeding. Then, on the left-side inferior, **Fig. 4** gives negotiators an idea of threats and opportunities and the

grade of concessions may be used to equilibrate them. These data derive from NRM module, which aims to manage negotiation’s risk (Fig. 2).

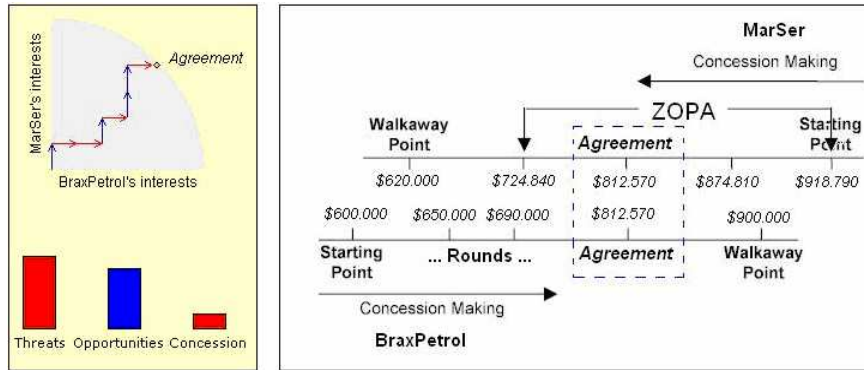


Fig. 4 Negotiation agreements, risks of threats and opportunities involved and the ZOPA

Besides, on the right-side of Fig. 4, it is possible to visualize the zone of possible agreement (ZOPA). This visual report provides negotiators the proposals’ cost of each negotiation round and the moment of agreement. The starting point and the walkaway point picture the concession making process.

Another approach is to use visualization methods supported through competence management. In this case, Fig. 5 presents a TreeMap that aids to choose negotiation group decisions through the search for professionals with similar negotiation competences. TreeMaps are efficient, compact displays and emphasize hierarchical structure. The methodology uses stored negotiations to infer which professionals have more capability to form a group decision or to substitute a negotiator in a deal.

In this TreeMap view, there are two parameters to be considered: square’s size and color. Size indicates the negotiator relevance in the current negotiation context while color suggests the negotiator experience based on the number of negotiations involved. As observed in Fig. 5, the larger the square, the greater the relevance of the negotiator in the context is; besides, the greener the square, the more experienced the negotiator is.

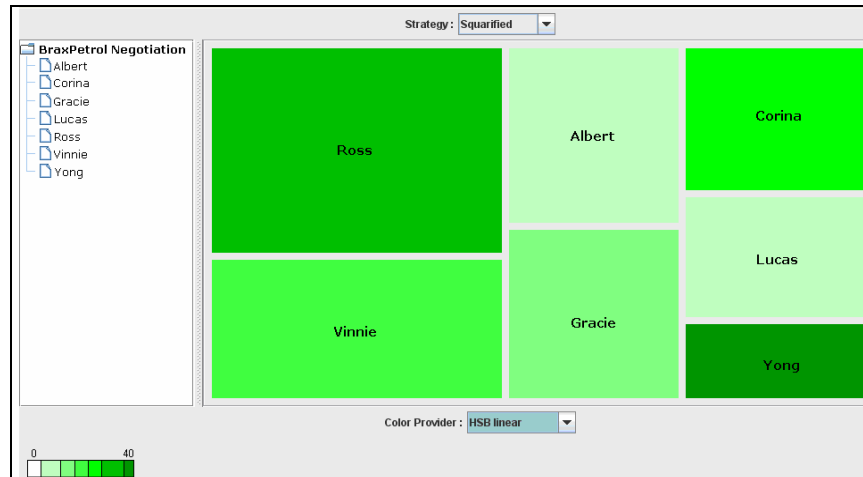


Fig. 5 TreeMap Visualization

In **Fig. 5**, a specific negotiation is used as reference, in other words, each negotiator's competence and experience are the input of the TreeMap visualization. For example, it is possible to verify that Ross is the most important professional in the negotiation selected in **Fig. 5**, although Yong has the major experience stored. On the other hand, in a downsizing process, Albert and Lucas may be the last choices to participate in this negotiation, once the squares' colors are so light.

This visualization technique allows the exhibition of great groups of hierarchical information through methods of space completion [26]. The TreeMap of this work can be built by using two algorithms: Squarified TreeMap [27] and Ordered TreeMap [28]. The Squarified TreeMap is presented in **Fig. 5**.

In general, the visualizations during the data analysis enable the information aggregation and cognition augmentation. Consequently, negotiators can observe and detect patterns once visualization methods show information that would be difficult to check and understand.

5 Conclusions

Visualization methods give users of Visual Negotiator the ability to control the display of a negotiation process. Its easy-to-understand interface makes it possible for all levels of negotiators to operate the functionalities proposed in this paper.

The presented visualization reports support the display of target graphs from complex negotiation scenarios and also suggest when the negotiation variables are critical or insufficient.

Visualization of the user's perception was shown to have the potential to be a powerful aid for understanding complex negotiation situations. This work also discussed

how to represent negotiators points of view, measure consensus among counterparts and visualize negotiation elements.

Besides, the article mentioned that limited teamwork in organizations means that their professionals sometimes do not know each other well, which jeopardizes knowledge creation and causes energy waste in many negotiation situations. Then, the use of TreeMap visualization is an approach for increasing the chances to find appropriate professionals to compose a group decision and also to facilitate the negotiator exchange, when necessary.

Furthermore, the work pointed out text mining techniques for extracting negotiation similarities and showed that mining tools can be used to discover professional's competence in order to reinforce the group decisions choices.

As future work, the expectation is to evaluate the usability of this methodology expanding this study for a large group of universities and organizations. In addition, it is planned to analyze and improve the coverage and accuracy of the negotiators' recovery using statistic temporal indicators in the calculation of their relevance. For example, recent negotiations could be more important because they indicate that the negotiator still operates in this domain. Another technological improvement would be to apply other supporting tools, such as Monte Carlo simulation, Pareto equilibrium graphics and negotiation clustering.

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