

NEGOTIATION STYLE AS PARAMETERS' DETERMINER TO ENHANCE PREDICTIONS OF SEQUENTIAL GROUP DECISION MAKING

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ABSTRACT

The analysis of subjective factors that influence on group decision making can be performed, for instance, evaluating the negotiation style of the participants involved. Negotiation style can be measured through TKI[®] scale, a self-report questionnaire that assesses individual's behavior in conflict situations and describes it along two dimensions: (i) assertiveness and (ii) cooperativeness. In parallel, refined models for a sequential group decision making should include psychological aspects of altruism and reciprocity. As an example, [Gimon and Leoneti 2020] proposed to model psychological components as a combination of two parameters, which are: (i) altruism and (ii) reciprocity, for refining a utility function that models multicriteria group decision making as games. In this work, we aimed to verify if TKI[®] can be efficiently used for parameters' definition of the refined utility function and to analyze if the refined utility function's predictability, within a heterogeneous sequential group decision-making process, can be enhanced by the knowledge of the negotiation style of each participant. This result is important for guiding group decision making process in organizations, since it is a common place in organizations nowadays.

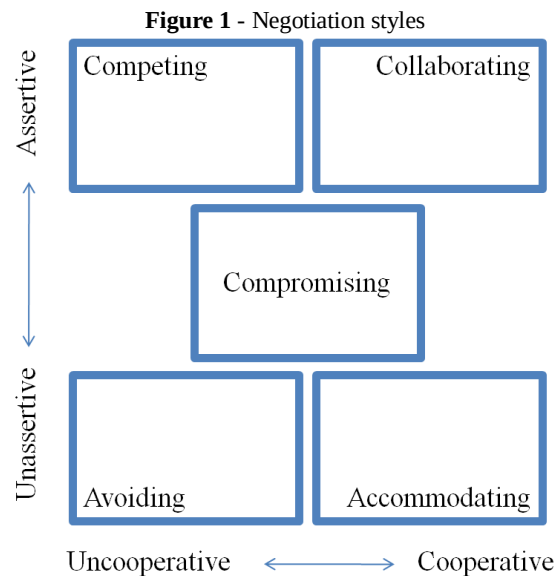
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1. Introduction

Most decisions at organizations are made in groups and are characterized by increasing availability of data and competitiveness, that managers usually have to deal with [Freitas and Kladis 1995; Freitas et al. 1996; Macadar et al. 1997; Freitas 1998; Lunenburg 2011]. However, within a group decision process, individuals can behave differently. Some intrinsic factors – cultural, values, beliefs and ethical principles – in the model is important to understand how participants make decisions [Hipel 2005; Carneiro et al. 2016; Carneiro et al. 2018]. The analysis of those subjective factors that influence on group decision making can be performed, for instance, evaluating the negotiation style of the participants involved. [Ziotti 2018], for example, analyzed the impact on commitment in a group decision environment through the application of a multicriteria method based on game theory, developed by [Leoneti 2016], and its evaluation by participants' sense of justice and negotiation style. Negotiation styles, used by [Ziotti 2018], were measured through TKI® scale, a self-report questionnaire developed by [Kilmann and Thomas 1977]. This instrument, also known as MODE (Management of Differences Exercise), assesses individual's behavior in conflict situations and describes it along two dimensions: (i) assertiveness, the level to which the participant attempts to satisfy his or her own concerns; and (ii) cooperativeness, the level to which the participant attempts to satisfy the concerns of another person [Thomas 2008].

According to [Thomas 2008], TKI® measures five styles for handling conflict: competing, collaborating, compromising, avoiding, and accommodating. Depending on the relationship with assertiveness' and cooperativeness' levels, each style can be represented graphically, as it is shown in Figure 1. In Table 1, there is a short description of each negotiation style, according to information presented by [Thomas 2008].



Source: Adapted from [Thomas 2008]

Table 1 - Negotiation styles description

Negotiation style	Characteristics
Competing	Competing is assertive and uncooperative. Individuals pursue their own concerns, defend opinions they think that are right and compete to win the discussions, potentially at other's expenses.
Collaborating	Collaborating is both assertive and cooperative. Individuals will work with another to look for a win-win solution and that fully satisfies the concerns of both.
Compromising	Compromising is intermediate in both assertiveness and cooperativeness. Individuals seek a quick middle-ground position and will work to find an expedient, an acceptable solution that partially satisfies both parties.

Avoiding	Avoiding is unassertive and uncooperative. Individuals will not pursue their own concerns or those of the other person. They will not address the conflict, either.
Accommodating	Accommodating is unassertive and cooperative. Individuals will neglect their own concerns those of another. There is a feature of self-sacrifice in this negotiation style.
Source: Developed by the authors, based on [Thomas 2008]	

In parallel, [Gimon and Leoneti 2020] realized that including psychological aspects in utility functions that measure participants' payoffs in group decision situations is relevant when strategic interactions are analyzed. In order to provide models, which are more realistic, for a sequential group decision process, [Gimon and Leoneti 2020] suggested the development of a refined utility function, which includes psychological aspects of altruism and reciprocity. In summary, [Gimon and Leoneti 2020] proposed to model this psychological component as a combination of two parameters, which are: (i) altruism, which it is the participant's kindness to the others, i.e. unconditional altruism; and (ii) reciprocity, which it is the reaction of participant towards how kind the others are being to him/her, i.e. reciprocal altruism.

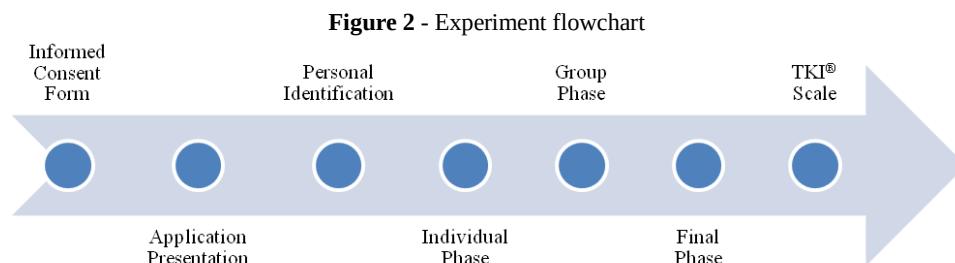
In our study, we propose to use TKI[®] negotiation style descriptions, developed by [Kilman and Thomas 1977], for setting the parameters of the refined utility function proposed by [Gimon and Leoneti 2020] on a sequential group decision experiment, according to the methodology presented by [Leoneti and de Sessa 2017], with the new cases proposed by [Ziotti and Leoneti 2020]. We aim to verify if TKI[®] can be efficiently used for parameters' definition of the refined utility function and to analyze if the refined utility function's predictability, within a heterogeneous sequential group decision-making process, can be enhanced by the knowledge of the negotiation style of each participant.

2. Method

For this study we used qualitative and quantitative analysis to evaluate the efficiency of the application of TKI[®] scale to a refined utility function by setting the psychological parameters of altruism and reciprocity. In this section we describe methodological details of this research, for example, the phases followed by each participant and the instruments that were used for collecting data.

2.1. Study design and participants

Two groups of five students from Campus Ribeirão Preto of University of São Paulo participated in the experiment. The methodology and cases applied on this study were based on [Leoneti and de Sessa 2017], with two new cases created by [Ziotti 2018]. The phases followed by each participant, from the beginning to the end of the experiment, are presented in Figure 2.



Source: Adapted from [Leoneti and de Sessa 2017]

2.2 Instruments and questionnaires

Firstly, students read the Informed Consent Form and agreed to participate in this research. The next step was to perform a presentation in order to contextualize the research's applicability and its goals. A summary of this presentation can be seen in Table 2.

Table 2 - Presentation of the experiment

Presentation	Topics
Instructions	Participants were informed about the instructions to solve three cases that they would have to decide after analyzing a set of criteria and alternatives; Participants should follow three different phases in order to solve each case: individual phase, group phase and final phase
Rules	Participants could not veto during the negotiation; Coalitions were not allowed during the individual phase; After finishing the negotiation, participants would have to vote secretly to confirm or not the group decision

Source: Developed by the authors

After finishing the presentation, participants filled out an Identification Form in order to collect personal data such as name, age, e-mail, undergraduate/graduate course and semester. Besides personal information, the Identification Form introduced a summary of the topics discussed throughout the presentation.

The next step was to start the simulation of cases proposed for each group decision making experiment. The following sequence of cases was applied: (1st) choosing a travel destination, (2nd) choosing an English language school, and (3rd) choosing a CEO for a company. For each case, participants had to evaluate a decision matrix composed by eight criteria and five alternatives. Details of each phase are provided in Table 3. All decision matrixes used in this research are available in Figures 3, 4 and 5.

Table 3 - Phases to analyze each case

Experiment Phase	Description
Individual Phase	Throughout this phase, participants should read and analyze both the case contextualization and decision matrix in order to rank criteria and alternatives according their preferences.
Group Phase	During Group Phase, a participant should negotiate in order to convince them that the group should choose the most preferred alternative. In the end, the group should present an agreement.
Final Phase	Individual voting happened during the Final Phase. If a breach of contract occurs, the decision suggestion presented by the method would be selected as the final decision. Otherwise, the group decision would be maintained.

Source: Developed by the authors

Figure 3 - Decision Matrix - Case 1: Choosing a travel destination

	Hotel evaluation	Travel time (hours)	Length of stay (nights)	Exchange rate	Shopping	Cultural attractions	Nature	Infrastructure
A	2.5	8 h	4	R\$ 0,90	5	3	7	8
B	3.5	2,5 h	6	R\$ 3,10	9	7	3	6
C	3	4 h	7	R\$ 4,70	4	5	9	7.5
D	5	13 h	5	R\$ 3,30	3	9	6	7
E	4	16 h	8	R\$ 1,10	6	8	5	5

Source: [Ziotti and Leoneti 2020]

Figure 4 - Decision Matrix - Case 2: Choosing an English school

	Distance in Km	Courseware	Number of students per class	Class hours per week	Infrastructure	School reputation	Extra activities	Course quality
A	14 km	R\$ 450	15	2	10	6	4	9
B	7 km	R\$ 650	12	3	9	8	5	8
C	16 km	R\$ 590	4	2.5	8	7	9	7
D	6,5 km	R\$ 570	8	6	5	8	6	8
E	10 km	R\$ 300	18	4	7	9	8	5

Source: [Ziotti and Leoneti 2020]

Figure 5 - Decision Matrix - Case 3: Choosing a CEO

	Professional qualification	Years of company	Years working in the area	Leadership positions	Ethics	Adaptation to change	Commitment	Professional influence
A	8	7	7	3	10	4	6	9
B	7	4	10	3	9	9	4	8
C	6	6	15	4	8	7	7	4
D	5	8	12	7	7	8	8	4
E	4	10	9	6	5	7	10	7

Source: [Ziotti and Leoneti 2020]

After finishing the group decision process for all three cases, each participant was invited, by electronic mail, to fill out TKI[®] scale using the Elevate[®] platform. This instrument is composed of 60 sentences which are presented in pairs. For each one, there are two statements, A and B, where the participant has to pick up the option that he or she thinks it is more similar to the behavior he or she would have in that negotiation environment. After scoring the items, a report was created using the Elevate[®] platform to interpret participants' negotiation styles. This report was shared with participants via electronic mail. Our study used the results of the experiment to evaluate if utility function's predictability may vary depending on the negotiation styles of each participant.

2.3 Models and data analysis

The utility function for multi-criteria decision problems proposed in [Leoneti 2016] was used to calculate utility values for each alternative, based on each participant's individual criteria weights and decision matrices. Note that the participants were not provided with this calculation during negotiation. Instead, they were free to choose their own method evaluate alternatives. However, having an utility function which represent participant's preferences allows us to evaluate their negotiation processes keeping in mind that some of their choices may have been made using different understanding of their own preferences.

To provide the methodology for the individual decision making strategies within group context, let us define an alternative j_{ic}^* for each participant i as her ideal choice such as $U_i(j_{ic}^*) = \max_j U_i(j), \forall j \in J_c$, where $U_i(j)$ is a utility of the alternative j calculated for the participant i using [Leoneti 2016], and J_c is a set of alternatives for case c . Let us define j_c^G as the the group decision for the case c , and j_{ic}^v as an alternative that the participant i supported on the voting stage

for the case c . Since the ideal choice is defined by the maximum of the utility function, $U_i(j_c^G) \leq U_i(j_{ic}^*)$ and $U_i(j_{ic}^v) \leq U_i(j_{ic}^*)$.

An absolutely rational and selfish participant should always propose j_{ic}^* . Because her selfishness, then during the group stage she should not be persuaded to change her choice to j_c^G . However, the group consensus still can be made depending on other participants. Because of that j_c^G is not indicative in any specific participants choice or change of the choice. Let us use an individual input on the voting stage j_{ic}^v to assess the change in the participant's choice. The reasons for these choice may include group stage persuasion supported by her own altruism and reciprocity. In other terms the change of the choices during the entire group decision making process can be described by a set of concessions each participant may ($C_c^i \neq 0$) or may not ($C_c^i = 0$) making

$$C_c^i = U_i(j_{ic}^*) - U_i(j_{ic}^v) \quad (1)$$

One of the ways to explain the rationale behind the concession making process in this case is by defining the new utility function ($U_i^v(j)$) in such a way that the actual participants choice on the voting stage would match this new utility function's maximum $U_i^v(j_{ic}^v) = \max_j U_i^v(j), \forall j \in J_c$. The refined utility function that explains participants choice in these settings has been proposed in [Gimon and Leoneti, 2020]. This refined utility function models an individual's utility in a group setting as an elastic choice between participants own utility and a collective gain of a group:

$$U_i^v(j) = U_i(j)^{\omega_i} \times \bar{U}(j)^{1-\omega_i}, \omega_i = \alpha_i \cdot H_i^C + \beta_i \quad (2)$$

where ω_i is an individual function describing participant's willing to play altruistically, H_i^C is history of perceived kindness of other participants prior to the case c , α_i and β_i are the degrees of the participant's reciprocal and unconditional altruism respectively, and $\bar{U}(j) = \frac{\sum_{i=0}^n U_i(j)}{n}$, for a group of n participants. Then a rational participant should choose j_{ic}^v such as $U_i^v(j_{ic}^v) = \max_j U_i^v(j), \forall j \in J_c$. Note that H_i^C component is a function of the order of negotiation cases and the perception of the outcomes in the cases negotiated in the past. While α_i and β_i are unknown neither for researchers nor for the participants themselves they represent each participant's physiological traits in the model. Therefore, it is assumed that the concession making behavior should be connected to those values.

During the experiment we have observed participants making concession and as result voting for alternatives j_{ic}^v which were different from their ideal choices j_{ic}^* . Those choices cannot be explained by the use of their individual utility $U_i(j)$. To test whether those choices and underlying concession-making may be explained by $U_i^v(j)$ various α_i and β_i may be tested to find the parameters of altruism and reciprocity for each participant, which will be the best fit to explain their concession-making. In other words, models with various α_i and β_i values should yield various accuracy in prediction of participant's voting choices. Therefore, we could estimate α_i and β_i by maximizing the number of correct predictions of voting choices (j_{ic}^v) through a simulation process. To do so it was solved the following optimization problem

$$\max_{\alpha_i, \beta_i} \sum_{i,c} P(j_{ic}^v, j_{ic}^v), \text{ where } P(j_{ic}^v, j_{ic}^v) = \begin{cases} 1, & \text{if } j_{ic}^v = j_{ic}^v \\ 0, & \text{otherwise} \end{cases}, \alpha_i, \beta_i = [0..1] \quad (3)$$

3. Results and discussion

Based on the data gathered from the experiment and calculated using the methods presented in the models and data analysis section, Table 4 presents the results of the negotiation steps (initial choice, group decision and voting). The table also presents the negotiation style of

each participant collected by using TKI® and the ideal alternatives, which correspond to the maximum utility by the utility function in [Leoneti 2016]. It also presents the method's recommendation, which corresponds to the maximum utility calculated by the refined utility function proposed by [Gimon and Leoneti 2019] using the optimal solution of the problem (3). According to the results in the referred table, it is possible to note that, in this study sample, the compromising style (it is characterized by an intermediate behavior in both assertiveness and cooperativeness dimensions) represented about 30% of the cases. On the other hand, collaborating (it is both assertive and cooperative) was the least identified. Note that due to the small number of participants (ten) the negotiation style distributions have no statistical significance. Based on the results of negotiations, it can be seen there was at least one consensus in each group (i.e. group decision matches voting of all participants).

Table 4 - Results of negotiations

Participant	Group 1						Group 2			
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Negotiation style	Avoiding	Competing	Compromising	Compromising	Accommodating	Accommodating	Avoiding	Competing	Compromising	Collaborating
Case 1										
Ideal choice by [Leoneti 2016]	E	B	D	D	C	A	C	E	E	A
Initial choice by the participant	E	B	D	E	C	A	A	E	E	B
Group decision	D						E			
Voting	C	D	D	D	D	E	E	E	E	D
Method's recommendation by [Gimon and Leoneti 2019]	C	B	D	D	C	E	C	E	E	A
Case 2										
Ideal choice by [Leoneti 2016]	D	B	A	B	B	D	D	A	A	A
Initial choice by the participant	D	B	B	B	B	D	D	B	B	A
Group decision	B						B			
Voting	B	B	B	B	B	B	B	B	B	B
Method's recommendation by [Gimon and Leoneti 2019]	B	B	B	B	B	D	D	A	A	A
Case 3										
Ideal choice by [Leoneti 2016]	E	A	E	B	C	A	C	E	E	E
Initial choice by the participant	D	D	A	D	A	A	D	D	D	D
Group decision	D						D			
Voting	D	D	A	D	D	D	D	D	D	D
Method's recommendation by [Gimon and Leoneti 2019]	D	D	E	D	D	D	D	E	E	E

Based on simulation procedure it was possible to define the parameters of each participant's altruism willing function α_i and β_i (Equation 2) by using brute-force search aiming to maximize the total number of matches between methods' recommendation for each participant and their respective vote. We selected the scenario with the highest number of matches (17), the distribution of the matches per case can be seen in Table 5. Note that the maximum possible number of matches was 10 for each case (30 in total). Given five alternatives in each case, a random (no prediction) should yield 2 and 6 matches for each case and in total respectively. It should be stressed that the refined utility function proposed by [Gimon and Leoneti 2020] had a similar performance in predicting the ideal choice for each participant in all cases proposed in this experiment. This results are similar with the ones which were obtained by [da Silva et al. 2020], indicating the relevance of including psychological aspects in the modeling of the group decision-making

process. The number of matches achieved by the non refined utility function proposed by [Leoneti 2016] is also described in Table 5. As it can be seen, the performance of the refined utility function was higher in all cases. Considering the total of matches, this achievement was approximately 142% higher.

Table 5 - Refined utility function performance in predicting the ideal choice for each case

	Number of matches (non refined utility function)	Number of matches (refined utility function)
Case 1	4	6
Case 2	3	5
Case 3	0	6
Total	7	17

Table 6 demonstrates the performance of the refined utility function in predicting the ideal choice according to the negotiation style of each participant. To describe this, the average of matches for each negotiation style was calculated. As can be seen in that table, the refined utility function had a similar performance in all negotiation styles but collaborating. This result in collaborating style may be explained by the low representativeness of the negotiation style in this study sample, indicating the necessity of performing the experiment in a higher sample in order to verify if this result can be improved. On the other hand, it was realized that the predictability performance was not influenced higher by the negotiation behavior than the refined utility function proposed by [Gimon and Leoneti 2020].

Table 6 - Refined utility function performance in predicting the ideal choice at the voting stage for each negotiation style

Negotiation style	Average of matches
Competing	1,5
Collaborating	0
Compromising	2
Avoiding	2
Accommodating	2

Considering the cooperativeness dimension, the level to which the participant attempts to satisfy the concerns of another person, it is implied that participants, with a cooperative negotiation style, would be more willing to make concessions. Therefore, it was calculated the average of concessions made by each negotiation style in order to validate this hypothesis. We considered as a concession when, during the voting phase, the participant selected an alternative which is different of his/her initial choice. So, it was summed the number of concessions which each participant made in the three cases. After this, it was calculated the average of concessions for each negotiation style. The results are presented in Table 7.

Table 7 - Average of concessions for each negotiation style

Negotiation style	Average of concessions
Competing	0,50
Collaborating	2,00
Compromising	0,33
Avoiding	2,00
Accommodating	2,50

According to the graphical representation created by [Thomas 2008], collaborating and accommodating are more cooperative. It can be seen from Table 7 that collaborating, accommodating and avoiding had the highest averages of concessions during the experiment. This result complements the previous hypothesis, because it was expected that only cooperative participants would make more concessions during the negotiation process. This fact can be

explained by the experiment's structure where it was specified that participants did not have veto power and, after finishing the negotiation, they would have to reach a consensus. Participants would have to present his or her preferences during the individual voting to define the decision group. Thus, participants, with an avoiding negotiation style, would not pursue their own concerns or those of the other person and, consequently, they would be more willing to change their preferences during the individual voting as well. Participants with avoiding style behavior can be also observed in Figure 5 where the average of utility concession in voting phase was calculated according to the equation (1) for each negotiation style. This utility concession was performed comparing the utility of the alternative which was chosen during the individual voting and the utility of the initial choice. It can be seen that avoiding was the negotiation style which changed his or her preferences during the negotiation process most.

Figure 5 - Average of utility concession in voting phase for each negotiation style

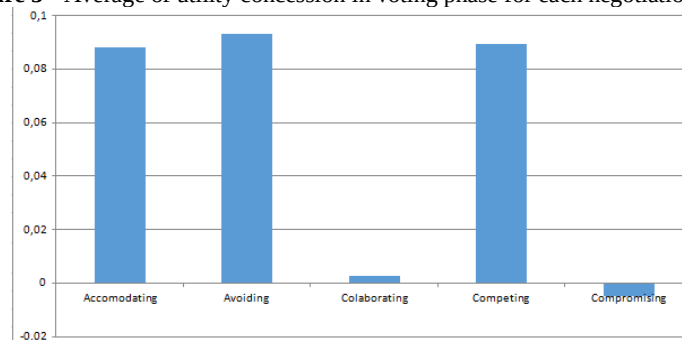


Table 8 presents α_i and β_i parameters that were settled to each participant by the simulation procedure. The negotiation style, measured with TKI[®] scale, is described as well. It is also interesting to stress that the highest counting for the matches occurred when the values of α_i tends to zero. This might be explained by the fact that in the experiment proposed here the three cases are not similar and, or by the participants did not see them as parts of a larger negotiation problem, which would imply the ability to compensate a lower outcome in one case(s) with higher outcomes in another case(s). Besides, just one participant, whose negotiation style is compromising, had an α_i parameter different of zero. As the compromising style seeks an acceptable solution that partially satisfies both parties, it is acceptable that participants with this negotiation behavior make the history of past agreements quite relevant to concession-making. So this negotiation style could have an α_i parameter different of zero as it occurred here.

Table 8 - Estimated participant's psychological styles

	Group 1						Group 2			
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Negotiation style	Avoiding	Competing	Compromising	Compromising	Accommodating	Accommodating	Avoiding	Competing	Compromising	Collaborating
α_i^*	0	0	0	0,3	0	0	0	0	0	0
β_i	1	0,1	0,2	0,7	0,5	0,8	0,5	0	0	0

Finally, the psychological style of each participant was compared with the negotiation style obtained from TKI[®] scale. The results are presented in Table 9. High values of β_i parameters would suggest cooperative behavior while low suggest competitive behavior, and α_i is the level of

participant's reciprocal altruism (i.e., the reaction of participant towards how kind the others are being to him/her). When $\alpha_i = 0$ and $\beta_i \neq 0$, participant's willingness is independent of his/her perception of the counterpart's kindness. When $\alpha_i = 0$ and $\beta_i = 0$, participant acts pure egoistically.

Table 9 - Estimated psychological styles for each negotiation style

Negotiation style	Average of alfa	Average of beta
Competing	0	0,05
Collaborating	0	0
Compromising	0,1	0,3
Avoiding	0	0,75
Accommodating	0	0,65

It can be seen that avoiding and accommodating participants had a higher β_i parameter value. These results coincides with the aspects (a higher average of concessions and a higher average of utility concession during the voting phase) which were discussed previously and that demonstrate the cooperative behavior of these participants during the negotiation experiment. Compromising participants had an intermediate level in unconditional altruism (β_i parameter) and a low value in reciprocal altruism (α_i parameter), indicating his/her intermediate behavior in both assertiveness and cooperativeness, as it is suggested by TKI[®] scale. Competing participants had a low β_i parameter, indicating that they have a competitive behavior, as it was identified during the experiment where these participants had a low number of concessions during the negotiations. However, collaborating had α_i and β_i parameters values that indicate a pure egoistic behavior which does not fit with this negotiation style, suggesting the necessity of performing the experiment in a larger sample since the collaborating style was not representative in this sample study (i.e., we had just one participant with collaborating style in Group 2).

4. Conclusion

Considering the significant higher number of matches in comparison to the utility function without refinements, which was approximately 142% higher, we might conclude that the refined utility function with the use of TKI[®] negotiation style for determining its parameters is a effective way for enhance group decision making. This result is important for guiding group decision making process in organizations, since it is a common place in organizations nowadays.

It is also important to note that, through the mathematical modeling of the sequential group decision making process as described in this word, it was possible to corroborate the assumptions of TKI[®] instrument. In this sense, it could be cited the fact that the use of the method here described can be used in other situations. Other studies could also increase the sample for confirmation of the hypothesis here validated.

A limitation of the study is the fact that the participants were not explicitly told that the cases should be treated as a sequential negotiation within the same group what, in additional to the individual's profiles, it may explain the lack of reciprocity. Furthermore, some of the concession-making may be explained by the lack of explicit presentation of the utility function calculation to the participants. Since we used a small sample in this study, it is important to mention the necessity of performing this experiment in a larger sample in order to confirm the hypothesis here validated and generalize the obtained results.

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