Favor Information Presentation and Its Effect for Collective-Adaptive Situation

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Abstract. This paper focuses on *favor information* among people as the factor to lead a group to "collective-adaptive situation" and explores its effect in "Barnga" as the cross-cultural game which aims at investigating how the players make an appropriate group decision. For this purpose, we propose the "favor marker" which appears as a favor for other players in Barnga system. The subjective experiment results with this system have been revealed that the players in both the system-based communication and face-to-face communication lead the collective-adaptive situation by using the favor markers, while being conscious on the difference of card rules which caused conflicts among players. In detail, the following implications have been found: (1) when the players meet their conflict at the first time, their intentions tend to be appear from their behaviors (e.g. gesture) without using the favor maker in the face-to-face communication, while their intentions are appeared by actively using the favor marker in the system-based communication; (2) after some conflicts, the favor marker in both types of communication showed the effect on making an aware of the difference of the card rules and facilitating behavior affected by such differences, which contributes to deriving a smooth group decision making.

Keywords: Human-agent interaction, group decision making, collective-adaptive situation, favor information, Barnga.

1 Introduction

In daily life, we often meet situations where we have to make a decision in a group when working together. Such group activities have a great potential of deriving larger results than the individual activities, but it's difficult to make a consensus of all opinions of members because the members have their own different mind even if they belong the same group. To investigate such a situation, Ushida et al. employed Barnga [1] as the cross-cultural game which aims at investigating the social group whose members have different mind. In their research, they designed the computer agent who tries to lead a group to collective-adaptive situation in the Barnga system [2]. Although Ushida's agents supported to lead a group to collective-adaptive situation by changing their opinions, the players in Barnga game respect other's opinion, arbitrate between their decisions, and change their behaviors, which indicates the difficulty of reaching the collective-adaptive situation.

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To overcome this problem, we focus on a *favor emotion* from other people as the one of the signals of human behaviors. According to Cialdini [3], such favor emotion becomes the factor of changing people's behaviors to adapt to others without causing large complaints. From such a feature, the purpose of this paper is to investigate an effect of the *favor information* in order to lead a group to collective-adaptive situation by introducing "favor marker," which is a function to express a sign of favor for other players in the Barnga system. Concretely, we analyze how the favor marker gives an influence on the players' behaviors and group's situation through the subject experiment on the Barnga system with the favor marker. For this purpose, we investigate whether the groups will reach the collective-adaptive situation or not by comparing the Barnga system with and without the favor marker.

This paper is organized as follows. The next section introduces Barnga game. The people's behavior is classified in Section 3, and the favor information is proposed in Section 4. Section 5 conducts the experiment and Section 6 discusses their results. Finally, our conclusion is given in Section 7.

2 Barnga Game

This section describes the features and specific rule of Barnga [1].

2.1 Features of Barnga

Barnga is studied in the context of the gaming simulation (GS) [4] as the cross-cultural experiences and its effectiveness in the cross-cultural understanding was reported from the viewpoint of the educational training [5]. Barnga is a trump game, where four or more players are allocated in the different tables and repeat to decide one winner in the table separately. The features of Barnga are summarized as follow:

(a) The card rules for the players are a slightly different from others depending on their first allocated table (See Section 2.2). For example, the diamond is the strongest suit in one table, while the heart is the strongest in the other table. What should be noted here is that the players are not told such a difference among the card rules. After a definite period in the game, a part of players move to the other table and then they begin to play the new game. Although the players in the same table nominate one winner at the same time according to their card rule, the different nominations for a winner occur in the new game because of the different rules in the same table.
(b) Since Barnga prohibits the verbal communications among the players in the game, it is difficult to communicate their intention even if their nominations are different.

From the above features, it is necessary for the players to decide one winner in a table by selecting a winner which does not follow their rules or decide no winner in order to proceed the game.

2.2 Card Rule

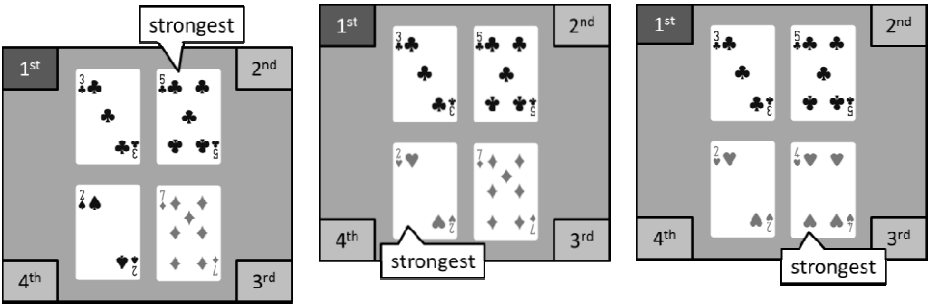
The card rule which defines the strength of cards is summarized as follows:

(a) There are the following two kinds of the strength order of card number from 1 (A) to 7.

(i) (strong) 7, 6, 5, 4, 3, 2, A (weak)
(ii) (strong) A, 7, 6, 5, 4, 3, 2 (weak)

(b) The strongest suit is defined as "trump."

For example, in a certain card rule, 7 is the strongest number and heart is the strongest suit. In Barnga game, the card which has the strongest number and same suit as the suit played first is strongest in a game basically. However if trump card is played, the card which have the strongest number and trump suit is the strongest. For instance, In Fig. 1(a) clover 5 is the strongest because it has the same suit as the first card and the highest number. In Fig. 1(b) heart 2 is the strongest because it has the trump suit. In Fig. 1(c) heart 4 is the strongest because it has the highest number in the trump suit.



(a) case 1 (b) case 2 (c) case 3

Fig. 1. Winner decision

2.3 Game Flow

Fig. 2 shows the game flow in Barnga, which is summarized as follows.

1. Seven cards are dealt to each player.
2. Each player plays a card from their hands by turns.
3. Each player nominates a player as a winner according to their card rules. When these nominations are the same, one winner is determined. In the case of different nominations or no nomination, the players should continue to nominate the same or different player as the winner by returning to (3).
4. A winner gets a score and they return to (2) until a time limit is over.
5. 1 round is completed, and both players with the highest/lowest scores move to another table.
6. (1)~(5) is repeated during a predetermined time period.

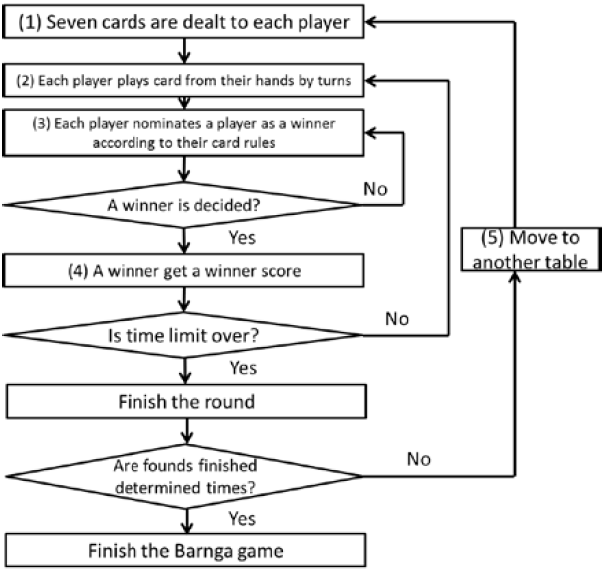


Fig. 2. Flow of Barnga game

2.4 The System of Barnga

Unlike the ordinary Barnga as the face-to-face game, Barnga in this research is played on the computer in the systems. Fig. 3 shows the image of Barnga system, which shows the player's names, images, and the scores of the players, in addition to a time limit and a turn of the player. The cards are displayed when the players are played, while the finger icons are displayed when the players nominate a winner. The players can play their card by clicking their hands.

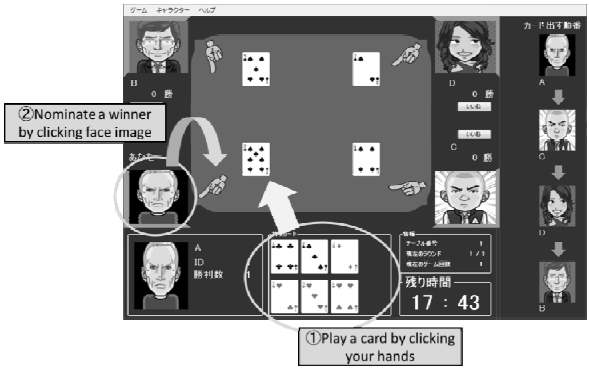


Fig. 3. Barnga Client Display

3 Player's Behavior Characteristic Classification

This paper employs the player's behavior characteristics and group situation classified by Ushida et al. [2] using Fuzzy C-means Clustering [7].

3.1 Player's Behavior Characteristic

As shown in Table 1 and Fig. 4, the three types of the players are classified by θ_N and θ_O defined as the average of the following two indicators: (1) insistence N_{ind} (the degree of nominating a winner) and (2) cooperation O_{ind} (the degree of following an opponent rule). Both indicators are calculated as follows, where G_{T_i} is the number of the game times as a target time (1 round in this experiment) in a table T_i, N_{round} is the number of times that a player nominate a winner in a target time, and N_{other} is the number of times that a player nominate a winner according to the opponent rule.

$$N_{ind} = \frac{N_{round}}{G_{T_i}} \tag{1}$$

$$O_{ind} = \frac{N_{other}}{N_{round}} \tag{2}$$

Fig. 4 shows features of each type. (i) Claiming player nominates a winner following the rule he first taught, (ii) Supporting player nominates a winner following an opponent rule and (iii) Quiet player doesn't nominate a winner at the time to select a winner.

Table 1. Classification of player's behavior characteristics

Behavior Property	Feature
(i) Claiming player	Nominate a winner according to their own rule.
(ii) Supporting player	Agree with a winner nominated according to the opponent rule.
(iii) Quiet player	Does not nominate a winner.

3.2 Group Situation

Ushida et al. [2] divided the group situation into the following four types of situations.

(a) **Domination situation:** In this situation, the players who have the same rule only nominate a winner and others do not nominate, which contributes to proceeding the game because only one winner is nominated. In contrast, the players who have different rules cannot insist on their opinions in this situation.

(b) **Confusion situation:** In this situation, the game does not proceed because all players tend to not nominate a winner due to an unclear of who should be nominated.

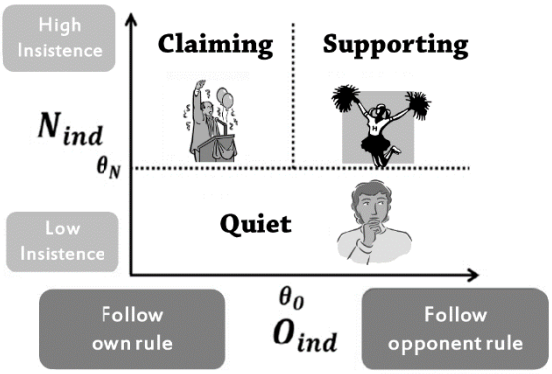


Fig. 4. Classification of Behavior Types

(c) **Insisting situation:** In this situation, the game does not proceed because the players who have different rules insist to nominate different winner, which causes the conflict.
(d) **Collective adaptive situation:** In this situation, the claiming players coexist with the supporting players who have a different rule but change their nomination according to the claiming player's opinion.

The four type of the group situation is classified by the three types of the players as shown in Table 2. In this table, "*1" means an existence of the players who have the same rule, "*2" means an existence of the players who have the different rules, and "*3" does not require an existence of the specific players. In (a) domination situation, there is no supporting player who has the different rule from claiming players. In (b) confusion situation, all players are quiet players. In (c) insisting situation, there are claiming players who have different rules. In (d) adaptive situation, there are supporting players who have different rules from claiming players.

Table 2. Behavior characteristics in group situations

Group Situation	Claiming player	Supporting player	Quiet player
(a) Domination	Y*1	N	Y
(b) Confusion	N	N	Y
(c) Insisting	Y*2	*3	*3
(d) Adaptive	Y*1	Y	*3

4 Favor Information Expression

4.1 Behavior Pattern Classification

As described in Section 2, the players first play a card according to their own rules without knowing differences among the rules. Such a situation may occur the

situation where the players nominate the different winners according to their own rules. This is not good from the viewpoint of making a consensus of the opinions among all players, but the game cannot proceed if nobody compromises with opponent rules. To overcome this situation, the players have to change their behaviors from the negotiation perspective. From this perspective, Cialdini classified the following seven patterns of the people's behavior, one of which is the factor in leading others to recognize requests in the one to one negotiation [3].

(1) Fixed-action patterns: It is the character that people do not analyze every matter carefully and make decision but responds to the trigger feature automatically. For instance, people respond to the feature "expensive" with judging to be "high quality." This character has a possibility of drawing out the compliance by producing the trigger feature intentionally.
(2) Reciprocation: It is the character that people bring back when they are given, even if they do not want to be given. This character is required socially because they are criticized if they do not bring back when they are given.
(3) Commitment and consistency: It is the character that people tend to behave in consistency because of the public eye and to make easier the action selection. This character promotes people to take action on what they accept to do once.
(4) Social proof: It is the character that people tend to behave in mimicry of others, especially the people who is similar to their decision in the uncertain situation, for example, there is information which is not known whether it is true or not.
(5) Liking: It is the character that people are liable to accept the request from more favorable, attractive people or whom they contact with in better situation.
(6) Authority: It is a character that people follow the authority which is proven by title, clothes, or ornaments.
(7) Scarcity: It is the character that people assign more value to opportunities when they are less available. They have a psychological reactance when they lose freedom of accessibility.

Among the above characters, we focus on (5) *liking* in this research because (i) the favor is the basic element of emotion which can change someone's feeling in a short time negotiation; and (ii) various favorable emoting functions such as web clap or "Like" button are used frequently to encourage communication in SNS or web services.

4.2 Favor marker

As the function to show a favor for other players in Barnga game, we implement the "favor marker" on the Barnga system. Figs. 5 and 6 show the user interface of Barnga system and how to use the favor marker, respectively. There are buttons written "Like" (hereafter, we call it Like button) which is below of other player's avatar images as shown in Fig. 6 and the player can display the favor marker by clicking the Like button nearby the target's image you want to show your favor at any times in a game. The players can see and understand that every favor marker in the table means a favor from others. After the player show the favor marker as the right of Fig. 6, the

"Like" text on the button he clicked change to "cancel" and he can cancel the favor marker by clicking the button again. The favor marker does not affect the game rule, victory, or defeat.

In the previous Barnga system which does not have a favor maker, the manifestation of intention of the players are limited, for example, only by nominating a winner or not, or taking time in playing a card. In contrast, the players become to be possible to manifest their favor for others distinctly by using the favor marker on Barnga system, which supports to derive the agreement among the players.

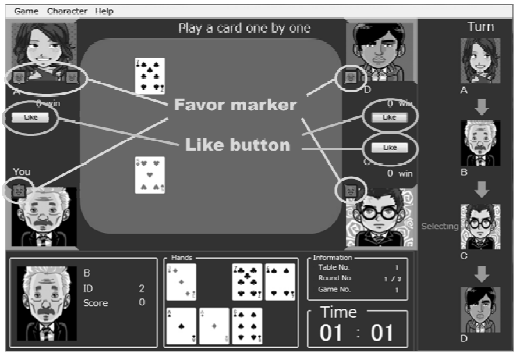


Fig. 5. Interface of Barnga system and favor marker

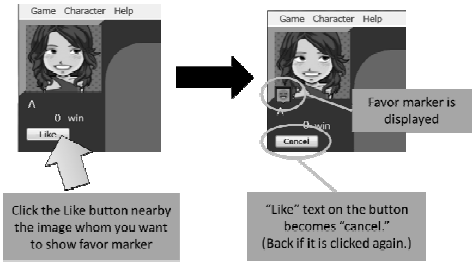


Fig. 6. How to use and display favor marker.

Table 3. Cases

	Case1	Case2
Communiaction	Face-to-face	System-based
Rule difference	Known	Known
Subjects	4	12 (4 players in each 3 tables)
Rounds	1	3
Time limit in a round	20 minutes	

5 Experiment

5.1 Cases

Table 3 shows the cases in our experiments. Subjects are 20-26 years old Japanese stundents of The University of Electro-Communications. There are 3 males and 1 female in case 1 and 10 males and 2 females in case 2. Case 1 conducts s Barnga game with the *face-to-face* communication employing the favor marker. In this case, the players have the favor marker *card* and they can express this card to other players during a game. The communication without the favor marker is prohibited. The players wear sunglasses and masks to hide their expression. We record this experiment on video and provide questionnaires after the game. Case 2, on the other hand, conducts Barnga game with the *system-based* communication (as shown in Fig. 5) employing the favor marker. The players are told that they can display or cancel the "favor marker" to others freely and they are not indicated to use the marker in the particular situation or for particular intention. We record this experiment by getting a data from logs of player's behavior in the game and provide questionnaires after the game.

The essential difference between cases 1 and 2 is to investigate the effect of the favor marker by comparing the results of the face-to-face communication and system-based communication (*i.e.*, the favor marker card vs. the favor marker in the computer). What is the same between cases 1 and 2 is that all player knows Barnga rule, *i.e.*, they understand clearly that others may have different rule as the first step towards our final goal.

5.2 Evaluation

The questionnaires ask the behavior and its intention, the frequency in use of the favor marker and its intention, the way to interpret the favor marker. Using these questionnaires, we evaluate quantitatively and qualitatively how to use the favor marker and whether the group reaches or not the collective-adaptive situation.

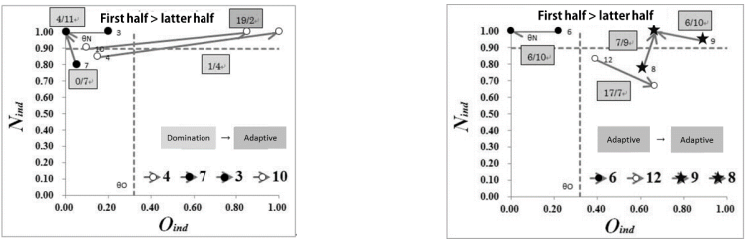
5.3 Results

Case 1: Face-to-Face Communication. The nominations mostly conflict at first and then some players change their nomination. Although the players told not to communicate verbally, they try to express their opinion by their behavior speed or small motions at the early step of the game when they are conflict. After they calm down, they begin to use the favor marker card mainly as a signal to inform that they have the same rule.

Case 2: System-Based Communication. When conflicting their nomination at first, they change their nomination similarly as case 1. They use favor marker to decide a winner in earlier than case 1. Although they cannot communicate without the favor marker, they smoothly reach at the collective adaptive situation. Fig. 7 shows the example of the transition of the behavior characteristics and Table 4 shows the result

of the percentage of the group situation and use of the favor marker in case 2. In this figure, the behavior characteristics of four players in the same table are plotted in this graph. In detail, such characteristics in the first half and the last half of one round are plotted as points on the graph and arrows which connect these points means the transition of behavior characteristics from the first half to the last half of the round. The vertical axis indicates insistence (N_{ind}), the horizontal axis indicates cooperation (O_{ind}), the horizontal dotted line indicates average of N_{ind} (θ_N), and the vertical dotted line indicates average of O_{ind} (θ_O) as described in subsection 3.1. From, the quiet players become the supporting player (Fig.7 (a)) and then the domination situation changes to the collective adaptive situation (Fig.7 (a)). A quiet player also becomes a supporting player in adaptive situation (Fig. 7 (b)). From table 4, the groups in all tables reach at the adaptive situation, and 92% of the players use the favor marker.

In order to investigate the reason why we obtain such a result, the questionnaires are analyzed. This analysis suggests that all players expect to use the favor marker to show their sympathy or bond to the players who have the same rule. The analysis also clarify that the players firstly nominate a winner according to their own rule which causes the conflict of the nominations and then they change their nomination by using the favor marker to decide a winner.



(a) case 2 example 1 (b) case 2 example 2

Fig. 7. Transition of the behavior properties in Case 2

Table 4. Percentage of group situation and use of favor marker

Group Situation				Use of favor marker
(a)Domination	(b)Confusion	(c)Persistence	(d)Adaptive	
0%	0%	0%	100%	92%

6 Discussion

6.1 Way to Use Favor Marker

The common role of the favor marker (including the favor marker card) in both the face-to-face communication and system-based communication in Barnga game is to

express a sign of sympathy to others. The players show the favor marker for someone who have the same or similar rule, and guess their relation and intention. This indicates that the favor marker is used to smooth the communication.

The difference of using the favor marker in the face-to-face communication and system-based communication, on the other hand, is summarized as follows: (1) in the face-to-face communication, the players cannot stop to express their emotion from their gesture even though their communicating without the favor marker is prohibited. It can be said that gesture come out naturally and it is prior communication way to the favor marker. This is the reason why the players express their emotion with their behaviors in the case of confusion or confliction but they come to use the favor marker after becoming to be calm; and (2) in the system-based communication, the players could not show their emotion, intention and mind with gesture, meaning that the players can only express such emotional behaviors by the favor marker.

6.2 Comparing System-Based Communication under the Situation Where Players Knows Rule Difference or Not

Our previous research [8] conducted the Barnga game with the system-based communication employing the favor maker under the condition where the players do *not* know the rule difference. The research [8] reported that the half of groups reach at the domination situation while other half reach at the collective adaptive situation. Some players try to change their behaviors and lead a group to the collective adaptive situation by using the favor marker, which indicates that the favor marker can work for their agreement. However, some players use the favor marker to say unfavorable emotion. Due to such a different using of the favor marker, the players cannot understand each other by reading mind in showing the favor marker.

By comparing with the result in the research [8], the result in this paper suggests that favor marker is effective on leading the collective adaptive situation when players have a common purpose such as deciding a winner. Conversely, the intention in favor marker is not transmitted when they have different purpose such as deciding a winner or winning a game like in [8]. This indicates that we have to promote the players to have a common intention to collect a group.

7 Conclusion

This paper focused on the *favor information* among people as the factor to lead a group to "collective-adaptive situation" and explored its effect in "Barnga" as the cross-cultural game which aims at investigating how the players reach at the group decision making. For this purpose, we proposed the "favor marker" which appeared a favor for other players in Barnga system. The subjective experiment results with this system have been revealed that the players in both the system-based communication and face-to-face communication lead the collective-adaptive situation by using the favor markers, while being conscious the difference of card rules which caused conflicts among players. In detail, the following implications have been found: (1) when

the players meet their conflict at the first time, their intentions tend to be appear from their behaviors (e.g. gesture) without using the favor maker in the face-to-face communication, while their intentions are appeared by actively using the favor marker in the system-based communication; (2) after some conflicts, the favor marker in both types of communication showed the effect on making an aware of the difference of the card rules and facilitating behavior affected by such differences, which contributes to deriving a smooth group decision making.

What should be noticed here is that these results have only been obtained from one example, Barnga. Therefore, the further careful qualifications and justification, such as an analysis of results by increasing the number of the players, are needed to generalize the effectiveness of the favor maker. The further effect of the favor information should be investigated in the case where the players could unify a meaning of showing their favor information. Such important directions must be pursued in the near future in addition to the following future research: (1) an exploration of the requirement for turning awareness to other players to agree their opinions in a whole group or awareness such as changing way to display the favor marker, and (2) an investigation of the effect of other emotional signals for group decision making.

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