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# Online BARNGA using Touch Panel

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Under researches of Human-Agent Interaction, we developed a simulation game*: Online BARNGA with touch panel* to evaluate how people deal with social problems, especially when their emotions are involved. Then we analyze these data to make agents that have similar characteristics as those of human beings. Our target is to make a social agent that could learn social rules then adapt itself into these rules, and to make the new agent more accurate than that in the former research.

## 1. Introduction

Within the development of social agents, the research of Human-Agent Interaction became more and more popular. We are now working on the research about how people adapt themselves into an unknown circumstance to develop that kind of agent which could be used to predict potential social conflicts.

Social agents are the kind of agents who could learn social rules autonomously then act proper behaviors adapt itself into the local rule just as human beings do. Therefore, imitating human's behaviors is a good method to implement this task. To observe people's behaviors in some scenarios that people deal with culture shocks and eventually merge into the new culture, we developed a simulation game, called Online [Hidefumi Ohmura, 2009]. Data then be analyzed later to generalize some representative patterns.

The game Online Barnga with touch panel, is developed from a former version Online Barnga developed by Dr. Hidefumi Ohmura. By using this experimental tool, Dr. Ohmura observed players' behaviors, mainly in the aspect of their group behaviors. He then generalized some patterns of the group behaviors and made an agent model.

Although the Online Barnga is a useful tool for the research in this field, there are some major shortcomings that may cause the observation not accurate enough. The Online Barnga has an indirect input method, for the game is played through mouse and keyboard, not enough to represent people's emotions. Besides, in this version, players play the game with only computers, not teammates, which is a huge difference with the original Barnga.

To solve these problems, we developed Online Barnga with touch panel. This system is a new version of Online Barnga. In this version, participants can play the game with a touch panel which enables the natural interface and the system can observe the emotional information by observing the speed of playing cards.

In the 2nd chapter of this paper, *Online Barnga* and the model will be introduced. In the 3rd chapter, *Online Barnga with touch panel* and experiments will be introduced. Data analysis will be introduced in the 4th chapter, and the 5th chapter is the summary.

## 2. *Online Barnga* and social agents

To make pattern models and social agents, players' behaviors of how he/she behaved to try to adapt himself/herself into a strange group were observed by using the simulation Game, Online Barnga, based on the original version of Barnga.

To make the observation more accurate, the new system introduced an extended function which is a mechanism to produce a winner for each round, because we believe that the better one performs under a rule, the quicker he/she may be able to adapt himself/herself into another one. Besides, there are several scenarios defined in the game to simulate some representative situations when people live in real word, e.g. a harmony group, groups with people come from other groups, chaotic groups, etc.

By introducing these mechanisms, patterns were found and social agents were made based on the discoveries. For example, in some groups, participants play the game according to rules of their group. However, in another group, participants may not obey these rules and almost every time, he may refute the dealer's decision. When the amount of penalty is large, participants obey the rules. But, when the penalty is small, participants tend not to obey the rule.

Besides, it was also observed that people tend not to cheat if majority do not cheat. However, oppositely, if lots of players cheat, others tend to be with the majority.

According to our former research, it is possible to measure the change of unknown rules in groups in digits. Based on this, by analyzing members of the group individually, not only the

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unknown rule, but also the comments to the distribution and diffusion could be acquired. [大村英史 2009]

## 3. *Online Barnga with touch panel* and experiments

Though *Online Barnga* is a successful and helpful research tool to observe people's behavior, there are some major shortcomings mentioned in the 1st chapter. We developed another version, *Online Barnga with touch panel*, to overcome these shortcomings to make the observation more accurate and try to find how emotions effect people's behaviors when they are confront of culture shocks.

Because the movement of people's finger could reflect his/her emotions sometimes, and iPhone/ iPod Touch/ iPad and other smart phones that use touch panel as an input tool. Besides, the user interface of these devices is very beautiful and friendly to users. Additionally, these devices have strong mobility and functions, so we tended to use iPhone as the platform of the *Online Barnga with touch panel*. It is the opportunity for us to use these fascinating features to provide experiment participants an easier, interesting, and more user-friendly game, which would mean that players will perform as close as their natural indeed.

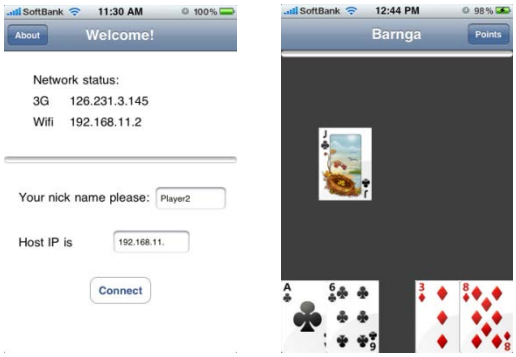


Fig. 1 ScreenShort of *Online Barnga with touch panel*

In this version, every player holds an iPhone which is connected to a PC server. In the server, playing information is stored into files, including players' cards, players' points, ranking, played cards, etc. Besides, players' trajectory of their movements is displayed on the screen in real-time to make sure other players could see the way the active player played cards and may be able to guess this player's emotion, which is helpful to strengthen the mutual relationship between players. The flow is simply introduced as the following.

a. Each table produces a dealer in a random way.
b. The playing process starts from the dealer, each one plays one card for one round.
c. After everyone played cards, the dealer selects the largest card according to his understanding of the rule.
d. Other players decide whether to claim the dealer's selection or not according to their understandings of the rule.
e. In chaotic situations, if the number of claims becomes majority, the dealer and who did not claim will be punished with points, and who claimed will be rewarded with points; in other situations, standards are rules, which means if the dealer's selection is right according to the rule, he and those who did not claim will be awarded with points, and those who claimed will be punished with points; if the dealer's selection is wrong, he and those who did not claim will be punished with points, and those who claimed will be awarded with points.
f. The position of dealer will be circled in the group.
g. After everyone in the group acted as a dealer, winner will be generated according to the point. The winner of each table has to move to the neighbor table.
h. After the movement of each table, game starts again as the 2nd round in the same way from step a to step g.
i. Game ends after the 3rd round.

It is easy to find out that in the 1st round, each player in one table share the same rule, which could be considered to be a harmonious scenario; in the 2nd round, for the winner of the neighbor table moved in, there are two sets of rules in one table, but the major rule is as the same as the former round, culture shock is not severe to who remain in the table; in the 3rd round, for there are two players moved in from other tables, there are 3 rules in a table, and the original one may lose its majority position in the table, so it becomes a chaotic scenario. In this scenario, no one could avoid culture shock.

It is obvious that levels of culture shock in these 3 stages are different, and we believe that people's emotions vary according to different levels of culture shocks.

## 4. Data Analysis

At first, we set some abbreviation marks to represent trajectory patterns and emotional patterns. Say S := slow; M := Medium speed; F := Fast; C := Confused; D := Determinant; U := Upset. With these symbolic marks, we could generalize trajectories into 2 or 3 letters in approximate way. The following figure in the next page demonstrates two examples.

The trajectory shown below is replayed by program from data stored in xml files. The direction of trajectories starts from the bottom, because cards' initial position lies in the bottom of the screen. In these trajectories, the width and color of trajectory curves depend on the speed. The slower the player's finger moves, the redder and thicker the curve will be. Oppositely, the

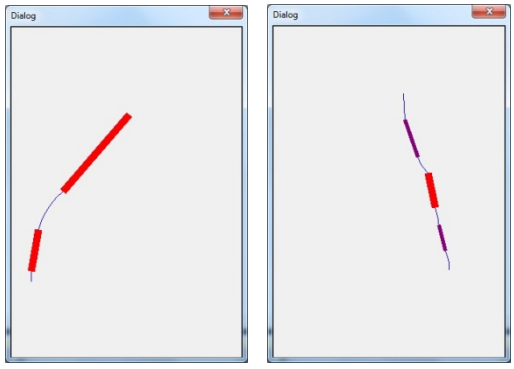


Fig. 2 two examples: SFS (left) & MSM (right)

faster the player's finger moves, the bluer and thinner the curve will be. The left trajectory starts with a low speed (red thick part), has a faster middle part (blue thin part), and ends with a low speed (red thick part), so it is represented as SFS (Slow-Fast-Slow); the right trajectory starts with a medium speed (purple mid-width part), has a low speed middle part (red thick part), and

ends with a medium speed (purple mid-width part), so it is represented as MSM (Medium speed-Slow-Medium speed).

During the experiments, players were asked to write down some notes right after they play each single card to log their performances for the future analysis, e.g. played card, change of their points, their emotions, etc. As it is mentioned before, emotions have been categorized into 3 kinds, C for confused, D for determinant, and U for upset. The following Table 1 is part of experiment logs.

| | 143 | | | 146 | | | 153 | | |
|---|---|---|---|---|---|---|---|---|---|
| ID | PATTERN | Δ SCORE | EMOTION | PATTERN | Δ SCORE | EMOTION | PATTERN | Δ SCORE | EMOTION |
| 111 | MFM | 20 | D | MFM | 20 | D | F | -20 | C |
| 112 | FMF | 20 | D | FFS | -20 | C | FFM | -20 | C |
| 113 | MFM | 20 | D | FMM | 20 | C | FMF | 20 | D |
| 114 | FMM | 20 | D | MFM | -20 | U | FFM | -20 | C |
| 115 | MMF | 20 | D | FMF | -20 | U | MFM | 20 | U |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 211 | SF | -20 | C | SFS | -20 | C | FSF | -20 | U |
| 212 | FMM | -20 | C | SFS | -20 | U | F | 20 | D |
| 213 | MFF | 20 | C | MSM | -20 | C | F | -20 | C |
| 214 | F | 20 | C | MFM | -20 | U | F | 20 | D |
| 215 | F | 20 | D | C | -20 | U | F | -20 | C |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 311 | C | 20 | D | F | 20 | D | FMF | -20 | U |
| 312 | MMF | 20 | D | F | -20 | C | C | -20 | C |
| 313 | M | 20 | D | F | 20 | C | FMM | -20 | D |
| 314 | MMF | 20 | D | F | 20 | D | MFM | -20 | U |
| 315 | FFM | 20 | D | F | -20 | C | MFM | -20 | U |

Table 1 Logs of 3 players

In the table, 1st row contains 3 players' names; in the 2nd row, PATTERN means the pattern of trajectories, Δ SCORE means whether the player got or lost points; the final column EMOTION is the emotion indicator. Besides, the 1st column of ID contains 3 digits, the 1st digit is the index of rounds, i.e. 3 tables 3 rounds; the 2nd is the index of sub-round in each round, i.e. 3 players 3 sub-rounds; the last digit is the index of playing cards, each player has 5 cards to play in each sub-round.

The following Table 2 is the statistics of these data to show relationships between patterns and emotion factors.

| | C | D | U | SUM | C | D | U |
|---|---|---|---|---|---|---|---|
| M | 23 | 34 | 21 | 78 | 29.40% | 43.60% | 26.90% |
| S | 8 | 2 | 5 | 15 | 53.30% | 13.30% | 33.30% |
| F | 45 | 48 | 35 | 128 | 35.10% | 37.50% | 27.30% |
| SUM | 76 | 84 | 61 | -- | -- | -- | -- |
| M | 30.30% | 40.50% | 34.40% | -- | -- | -- | -- |
| S | 10.50% | 2.40% | 8.20% | -- | -- | -- | -- |
| F | 59.20% | 57.10% | 57.40% | -- | -- | -- | -- |

Table 2 Statistics information of the experiment

From the table shown below, it could be found that within all data in Medium speed, the probability of emotion Determinant is obviously larger than other 2 emotions, occupied 43.6%; emotion Confused and emotion Upset has almost the same probability, 29.4% and 26.9% respectively.

As the same way, when the player plays a card in a low speed, it probably means that the player is confused, for the probability of confusion in Slow occupied 53.3%, 20% larger than the 2nd emotion.

The probability of players to be confused and to be determinant almost equals to each other when the player plays a card in a high speed.

However, there's a question that it seems that in all 3 emotions the probability of playing cards at a high speed (59.2% in the emotion Confused, 57.1% in the emotion Determinant, 57.4% in the emotion Upset) is much larger than the other 2 speeds, which seems to be not reasonable. How could a player tend to play cards in high speed under any emotion?

By researching patterns of the player 146, it could be found that in the 1st round, the player almost played cards in medium speed, but the performance is not satisfying; in the 2nd round, the player mainly performed in a slow way, the player's emotion changed in large scales, but performance is no better than that in the 1st round; in the final round, the player always played cards in a fast way, and negative emotions occupy major parts. The same phenomenon happened in the other player.

## 5. Summary

We found some phenomenon and confirmed one hypothesis by researching the data accumulated in experiments. However, till now, it is not so accurate when emotions are involved.

We are preparing to conduct more experiments for a more accurate analysis and researches.

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