The Effects of Human Personality on Human-Agent Interactions

(Doctoral Consortium)

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ABSTRACT

Currently more and more agents are involved in human routine activities and a mixed human-agent society is thus formed by the humans and the agents involved. The relationship between humans and agents in this mixed society is subtle and it is vital to explore the influence that agents bring into the society. In this paper, we try to investigate a few questions: will humans act differently towards a person and an agent? Do humans' personality types influence their decisions? To figure out these questions, we use the Keirsey Temperament Sorter-II (KTS-II), which is related to Myers-Briggs Type Indicator (MBTI) to test human subjects' personality types. Then the cake-cutting game and the ultimatum game are played by the human subjects and the agents. Though the ultimatum game was used in preceding works to study human behavior, only human subjects were used and KTS-II was not used. We expect that humans will treat a person and an agent differently and personality types will influence humans' decision.

Categories and Subject Descriptors

J.4 [**Social and Behavioral Sciences**]: Sociology

General Terms

Experimentation, Human Factors

Keywords

Human-Agent Interactions, Experimental, Mixed Human-Agent societies, Human Behavior

1. INTRODUCTION

It is common that agents take part in humans' life today. However, the feelings towards agents are subtle. For example, while enjoying the convenience that the agents bring us, some people are worried that robot, which is a kind of agent, will get enough intelligence and kill humans. So our first question is: will humans act differently towards a person and an agent? Bartneck, Hoek, Mubin, and Mahmud[1] showed that humans treat agents of different intelligence differently, while our experiments are designed to see whether humans treat a person differently from treating an agent.

Our other question is: does the personality type matter to the decision that a human makes? In order to investigate this, we introduced the Keirsey Temperament Sorter-II (KTS-II). KTS-II is developed by Keirsey[2], which has four personal types whose names are from Plato's book *The Republic*: Artisan, Guardian, Rational, Idealist. KTS-II is close related to a popular personality type indicator: Myers-Briggs Type Indicator (MBTI). MBTI has four dichotomies representing four aspects of human personality, as shown in Table 1.

Table 1: MBTI Dichotomies

Extraversion(E) - Introversion(I)
Sensing(S) - Intuition(N)
Thinking(T) - Feeling(F)
Judging(J) - Perception(P)

Table 2: KTS-II types corresponding to MBTI types

KTS-II type	MBTI types
Artisan	ESTP, ISTP, ESFP, ISFP
Guardian	ESTJ, ISTJ, ESFJ, ISFJ
Rational	ENTJ, INTJ, ENTP, INTP
Idealist	ENFJ, INFJ, ENFP, INFP

A person could take a questionnaire and get his/her MBTI type, which is a four letter combination with each letter from one of the dichotomies. For example, a person with type ESTJ means he/she is extravert, more likely to trust information that can be understood by five senses, tend to make decisions rationally and follow scheduled activities. KTS-II has four personality types corresponding to MBTI's sixteen types, as seen in Table 2. KTS-II focuses more on behavior while MBTI focuses on how people think and feel, which makes KTS-II a perfect fit for our experiments.

Schmitt, Shupp, Swope, and Mayer[3] used human subjects with MBTI types to investigate how personality types influence behavior in the ultimatum games, which will be explained in the next section. They revealed that "thinking" types made lower offers than those with "feeling" types and "extraverted" types were willing to accept offers less than "introverted" types. In our experiments, we use KTS-II types rather than MBTI types. Since we emphasizes the interaction between human and agents, we have agents play a part

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Table 3: Rewards of players

Rewards	Left part of the cake	Right part of the cake
Player A	x^2	$1-x^2$
Player B	x	$1-x$

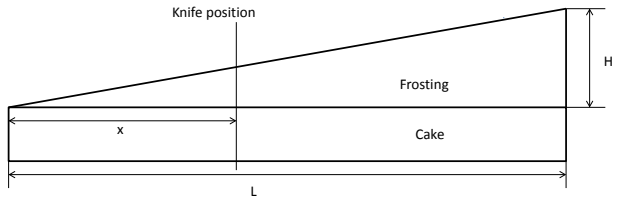

Figure 1: An example of the cake-cutting game

in our ultimatum game. The rest of the paper is organized as follows. In section 2, we'll explain the experiments in detail. In section 3, expectations of the experiments are discussed.

2. EXPERIMENTS

We begin our study by testing human subjects' KTS-II type according to the questionnaire in [2]. Then the subjects are guided to play two games: the cake-cutting game and the ultimatum game. Each game has two phases. In the first phase the game is played by human players and an agent is learning from what the human players do. In the second phase a human player will play with an agent.

It is common that agents in a multiagent system share some resources, thus the allocation of these resources is important, especially when the resources are scarce. We first use one of the resource allocation games - the cake-cutting game to do our experiments. This game asks participants to divide a cake between them in a fair manner. We take two participants in this game. For two participants, there is a fair and envy-free solution for this game: one participant cuts the cake and the other participant takes one of the two pieces of the cake first. We use more precise mathematical model to describe this game. Assume we have a rectangular cake and there's uneven frosting on it. The profile of the frosting is a triangle or some other mathematical distribution shape. Let's say the participant who cuts the cake is player A, and the one who take the cake first player B. Player A and B's rewards are calculated using the equations below. Let R_i be the reward of i. F_i is the amount/percentage of frosting i gets and C_i is the amount/percentage of the cake (without frosting) i gets, where $i = A, B$. The rewards equations we defined are as follows, where a, b, c, d are coefficients.

$$R_A = a * C_A + b * F_A \tag{1}$$

$$R_B = c * C_B + d * F_B \tag{2}$$

For example, Figure 1 shows the profile of a cake with a triangle frosting. The perpendicular line shows where player A put his/her knife to cut the cake. x shows the percentage of the leftpart of the cake. L is the length of the cake and H is the height of the frosting triangle. Let's say $a = d = 0$ and $b = c = 1$, which basically means A only cares about the amount of the frosting he/she gets and B only cares about the amount of the cake. Then using a formular that calculates a triangle's ares, if player A gets the left part of the cake as shown in the figure, A's reward will be:

$$R_A = \frac{\frac{1}{2} * x * L * x * H}{\frac{1}{2} * L * H} = x^2 \tag{3}$$

Using similar method, we could calculate all the rewards, as shown in Table 3. So for player A, solve the equation $x^2 = 1 - x^2$, we could get the x value of A's balance point: $\frac{\sqrt{2}}{2}$, which is approximately 0.707. The balance point means if A cuts the cake according to this x percentage value, he/she could get the same rewards picking either part of the cake. Similarly, we find out $x = 0.5$ at player B's balance point. It's easy to see that for player A, he/she should cut with x value between 0.5 and $\frac{\sqrt{2}}{2}$ to get at least 50% rewards. Which x value would player A actually pick to cut the cake? If players A and B are both human, will player A act benevolent towards player B by using a bigger x value in this interval to let player B get more rewards than that of cutting at B's balance point? Do people with different KTS-II types choose x values significantly different? In the second phase of the cake-cutting game, A is played by a human and B is played by an agent. Will player A treat the agent the same as he/she treats a human? Will KTS-II types influence the choice of x values towards agents? These are the questions that we want to answer by playing this game.

The ultimatum game is a resource allocation game, and is different from the cake-cutting game. In the ultimatum game, player A decides how to divide some amount of money, then player B chooses to accept or reject. If B accepts, then players A and B get the money according to A's proposal. If B rejects, none of them receives anything. In the first phase of the ultimatum game, A and B are played by human subjects. In the second phase, first A is played by a human and B is played by an agent, then vice versa. We are trying to find out whether humans treat a person and an agent differently in this situation and whether there's a difference between humans' reaction to a person or an agent.

3. EXPECTATIONS

We expect that humans would treat a person and an agent differently. For example, in the cake-cutting game, a human might act benevolent to another human than to an agent by cutting the cake differently. Meanwhile, personality types have affect on what a human decides to do towards a human, as shown in [3], and this affection should exists while a human's opponent is an agent. It is hard to say whether a human would treat a human's and an agent's offer differently. In conclusion, we expect that both personality types and the opponent's type (a person or an agent) influence a human's decision.

4. REFERENCES

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