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Cross cultural report of values and decisions in the multi round ultimatum game and the centipede game

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Abstract

This paper investigates the cultural differences in decision making behavior of people from the US and India. We study players from these cultures playing the Multi Round Ultimatum Game and the Centipede Game online. In order to study how people from different cultures evaluate decisions we use criteria from the Multi Attribute Relational Values (MARV) survey. Our results confirm the existence of cultural differences in how people from US and India make decisions in the Ultimatum and Centipede games. We also observe differences in responses to survey questions implying differences in the amount of importance that the two cultures assign to the MARV decision making criteria.

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Keywords: Cross cultural decision making; Values and decision making; Online games; Ultimatum game; Centipede game

1. Introduction

Comparative research from diverse societies shows that human social decision making behavior varies across cultures [1]. Efforts to explain this cultural variation have investigated a broad range of domains that are involved in social decision making. Notions such as cooperation, fairness, trust, punishment, aggressiveness, morality and competitiveness play important roles in evaluation of decisions. The values have also been shown to influence decision making as well. We compare two national cultures, the US and India, in terms of their game playing

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behaviour and the evaluation of their decisions. In particular, we are focusing on decision-making behavior in the context of simple negotiation games.

This work studies what decisions people make when playing the Ultimatum game and the Centipede game and the corresponding self-reported level of importance that they assign to different evaluation criteria when making their decisions. One method for eliciting people's values is through self-report on surveys. We use the 8 valuation criteria survey called MARV for this purpose. MARV stands for Multi Attribute Relational Values [2]. This survey was previously proposed and used for prediction of people's decisions in [3, 4]. The MARV decision making model itself is a multi-attribute utility-based decision making model [5] suitable for simulation of decisions in social contexts as it allows different weights to be assigned to different possible valuations of the situation [6, 7].

The rest of the paper is structured as follows: section 2, reviews background and related work. In Section 3, we present our experimental design and data collection method and provide more details on the Centipede game and Ultimatum games and the MARV values survey. In section 4 we report the results of the two games. We conclude in section 5 with a discussion of future work.

2. Related work

Country-level differences are observed in different levels of social, cultural, financial and economical behaviour. A high level economic example is the difference in behaviour towards the security of property as public good [8]. Decision making behaviour also varies from culture to culture. A very good example of work demonstrating country level differences in decision making behaviour is [9] in which four countries of Israel, Japan, US and Yugoslavia are studied in terms of bargaining and market behaviour.

Behavioural scientists interested in studying human decision making behaviour often use games as a tool in research. These games are intended to simulate and reflect certain aspects of real world decision making situations. The cross cultural research has also used games for studying decision making [1]. Heinrich et al., [10] studies the influence of culture on decision making process in economic domains by running the ultimatum, public goods, and dictator games among 15 small-scale societies. This study not only reveals substantially more behavioural variability across social cultural groups than has been found in previous research but also suggests that group-level differences in economic organization and the structure of social interactions explain a substantial portion of the behavioural variation across societies.

In traditional behavioural studies people participated in face to face laboratory conditions but recent studies have begun to look into patterns of behaviour in games when people are recruited on crowdsourcing platforms and play the games with one another online [11]. These studies have shown that behaviour observed when running economic games experiments online is comparable to those run in laboratory setting even when very low stakes are used for payment on the online platform [12]. Classical findings in behavioural studies such as the effect of framing and priming have also been re-established in online experiments with Mechanical Turk participants (e.g. [13]). Experiments have alleviated concerns about the validity of economic games experiments run online versus run in the laboratory by showing that self-reported demographics on Amazon Turk in these tasks are reliable [14, 15].

3. Experiment

In this work we use an interactive online platform for investigating cultural differences in decision making for two economic games: the Ultimatum Game and the Centipede Game. In this section we describe the experimental procedure, while results are presented in the next section. We describe the game interface, games,

3.1. Games

The Ultimatum Game is a simple bargaining game for two players in which the first player, often called the "Proposer" is provisionally allotted a divisible "pie" (usually money but in our experiment 100 points was split in each round of the game). This stylized negotiation was first studied in [16]. The proposer then offers a portion of the pie to a second person, often called the "Responder." The responder, knowing both the offer and the total amount of the pie, then has the opportunity to either accept or reject the proposer's offer. If the responder accepts, he or she

receives the amount offered and the proposer receives the remainder (the pie minus the offer). If the responder rejects the offer, then neither player receives anything. In either case, the responder's decision concludes one round in the game. The game continues for ten rounds and the two players get a chance to accumulate points. The players are informed that points accumulated in the game are converted to a monetary compensation for them. Thus they are provided an incentive for achieving more points in the games.

The Centipede Game (first introduced in [17]), is a two player game in which players alternate deciding whether to invest in a possibly higher payoff in the future, or take a payoff early. One player is denoted as "Red" and the other as "Blue". The red player starts the game. The players play over two piles on the table: "Big pile" initially has 4 points and "Small pile" has 1 point at the beginning. The game is played for up to 6 rounds, where the player with the turn that round decides whether he wants to take the bigger pile for himself and leave the smaller pile for the other player or pass the turn to the other player. Each time a player passes, the piles double in size. For example this means that if the Red player passes in the first round, the size of the big pile becomes 8 and the small pile becomes 2 in the second round and Blue decides what to do next. However the game can only go on to 6 rounds and if no player has taken the big pile for themselves up to that point, the piles disappear and players are left with nothing. The points accumulated in the game are converted to dollar compensation for the players.

3.2. Game interface

The game interface is a web application that we have developed to allow two (or more) players to play interactive games with one another online. The server pairs up players who get connected to the server and assigns the roles of the game to the players and provides them with the instructions and needed choice for making decision in the game. Figure 1 shows an example view of the interface for the player that is playing the Responder role in round 2 of the multi-round Ultimatum game.

3.3. The MARV value survey

The MARV value survey, introduced by [2], is a survey of different possible goals that might motivate decisions (positively or negatively) in a social game, such as those in Section 3.1 Table 1 shows the list of these values. Participants were asked to indicate how important each factor was in their decision making process, on a scale from -5 (very important to avoid) to 0 (not important) to 5 (very important to have). Traditional economic game theory assumes that all value is given to V self and no other values are considered.

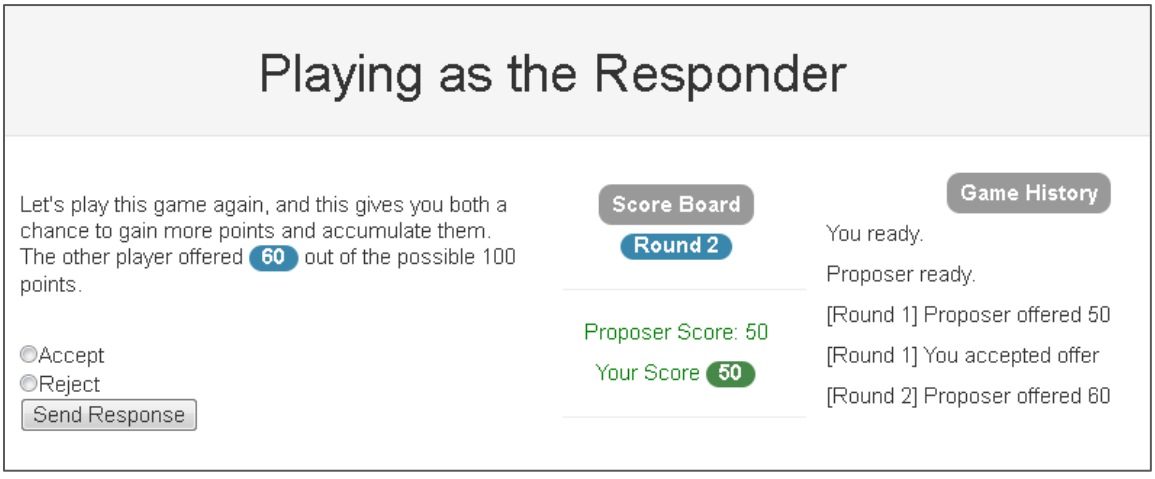

Fig. 1. A snapshot of the user interface for the proposer role in the multi-round Ultimatum Game.

Table 1. Decision-making Values in MARV model.

Abbreviation	Value Description	Corresponding Question in Survey
V self	Getting a lot of points	Getting points for yourself
V other	The other player getting a lot of points	The other player getting points
V compete	Getting more points than the other player	Getting more points than the other player
V equity	Having the same number of points as the other player	Getting the same amount of points as the other player
V joint	Making sure that if we add our points together we got as many points as possible	Getting as many points as possible for both players combined
V Rawls[18]	The player with fewest points (whoever that is) gets as many as possible	The player with fewest points (whoever that is) gets as many as possible
V lower bound	Making sure to get some points (even if not as many as possible)	Making sure to get some points (even if not as maximum possible)
V chance	The chance to get a lot of points (even if there's also a chance not to get any points)	The chance to get a lot of points

3.4. Participants

Participants from the US and India were recruited on Amazon Mechanical Turk. We used Mechanical Turk's control filters for recruiting people from the different countries and verified the selection by checking their IP address and the responses they provided to the questions in the initial demographic survey. 98 pairs of US players played the games and 54 pairs from India played the games.

3.5. Procedure

The players responded to a demographic survey before playing Ultimatum game and the Centipede game, using the game interface. Each player played both games but the ordering of the games was randomly determined so that ordering of the games does not affect the results of the analysis. The players were paired up to play the two games with another player from their own culture but they didn't necessarily play both games with the same partners. Their roles in the game were also randomly assigned to them. The players responded to the 8 question MARV survey (described in section 3.3) two times during the Ultimatum Game: after they made their decision in the first round of the game and after they made their decision in the final round of the game. They filled out the survey once during the Centipede Game after they made their first decision. Each participant was told they would receive a minimum $0.5 fee for participating in the task and they had the opportunity to earn up to a dollar based on the amount of points they accumulated in the games.

4. Results

4.1. Ultimatum Game

Table 2 shows the distribution of offers across rounds of the game for US players. Table 3 shows the likelihood of acceptance of each offer amount in different rounds. Similarly table 4 shows the distribution of offers for the Indian proposers and the acceptance likelihood of the offers by Indian responders. The canonical assumption in this game would predict that the proposers would offer the minimum possible offer to the other person but numerous studies have shown that people deviate from this prediction and make considerable amounts of the pie offers to the other person [1]. Similar to the reported results of different previous studies we also observe that rather than offering the minimum positive offer of 10 to the other player, the majority of the participants from both US and India offer more to the other person throughout the game. The majority of US players make an offer of 50 out of 100 to the other player in all the rounds of the game. Similarly the majority of Indian players offer 50 to the other player across round. However the ratio of the US people that offer 50 is higher than the ratio of the Indian people who offer 50 for all the rounds in the game. Average offers for the US players in the ten rounds of the game are: 48.08, 45.56, 48.99, 48.89, 46.26, 46.67, 45.56, 45.15, 44.55, 46.97.

Table 2. Relative frequency of offers made by US proposers.

US	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	Round 9	Round 10
Offer 0	0.01	0.01	0.01	0.01	0.00	0.03	0.04	0.05	0.05	0.02
Offer 10	0.00	0.04	0.00	0.01	0.05	0.02	0.01	0.00	0.02	0.04
Offer 20	0.04	0.04	0.04	0.04	0.03	0.05	0.02	0.06	0.06	0.04
Offer 30	0.01	0.08	0.06	0.03	0.07	0.08	0.10	0.06	0.01	0.04
Offer 40	0.17	0.12	0.13	0.16	0.15	0.12	0.15	0.12	0.14	0.14
Offer 50	0.73	0.65	0.64	0.65	0.61	0.59	0.61	0.62	0.68	0.63
Offer 60	0.00	0.03	0.04	0.03	0.05	0.04	0.03	0.06	0.02	0.04
Offer 70	0.01	0.00	0.02	0.01	0.01	0.02	0.01	0.01	0.00	0.00
Offer 80	0.00	0.01	0.03	0.03	0.01	0.01	0.00	0.00	0.00	0.00
Offer 90	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.02
Offer 100	0.03	0.01	0.02	0.03	0.01	0.03	0.03	0.01	0.01	0.03

Table 3. Acceptance likelihood of offers by US responders.

US	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	Round 9	Round 10
Offer 0	0.00	0.00	1.00	1.00	-	1.00	0.75	0.40	0.20	0.00
Offer 10	-	0.00	-	0.00	0.60	0.50	1.00	-	0.00	0.75
Offer 20	0.75	0.50	0.25	0.25	0.67	0.40	0.00	0.50	0.50	0.25
Offer 30	1.00	0.88	0.67	0.67	0.43	0.38	0.20	0.17	0.00	0.75
Offer 40	0.59	0.67	0.54	0.69	0.67	0.50	0.73	0.58	0.64	0.50
Offer 50	1.00	0.95	0.95	0.97	0.94	0.98	0.95	0.98	0.99	0.94
Offer 60	-	1.00	1.00	1.00	0.80	0.75	0.67	0.83	0.50	1.00
Offer 70	1.00	-	1.00	1.00	1.00	1.00	1.00	0.00	-	-
Offer 80	-	1.00	1.00	1.00	1.00	0.00	-	-	-	-
Offer 90	-	1.00	1.00	-	1.00	0.00	-	0.00	1.00	1.00
Offer 100	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table 4. Relative frequency of offers made by Indian proposers.

India	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	Round 9	Round 10
Offer 0	0.02	0.02	0.04	0.04	0.02	0.06	0.06	0.00	0.04	0.00
Offer 10	0.09	0.09	0.02	0.11	0.04	0.06	0.04	0.07	0.06	0.11
Offer 20	0.02	0.06	0.04	0.06	0.07	0.06	0.06	0.09	0.11	0.02
Offer 30	0.04	0.07	0.07	0.11	0.13	0.04	0.11	0.11	0.09	0.11
Offer 40	0.13	0.20	0.19	0.11	0.07	0.22	0.17	0.11	0.07	0.07
Offer 50	0.56	0.30	0.31	0.33	0.39	0.30	0.37	0.33	0.41	0.39
Offer 60	0.04	0.15	0.06	0.09	0.09	0.11	0.06	0.11	0.06	0.13
Offer 70	0.02	0.02	0.11	0.04	0.07	0.02	0.06	0.06	0.02	0.06
Offer 80	0.04	0.02	0.04	0.02	0.04	0.02	0.00	0.04	0.06	0.04
Offer 90	0.00	0.04	0.02	0.02	0.00	0.07	0.04	0.04	0.04	0.00
Offer 100	0.06	0.04	0.11	0.07	0.07	0.06	0.06	0.04	0.06	0.07

Table 5. Acceptance likelihood of offers by Indian responders.

India	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	Round 9	Round 10
Offer 0	0.00	0.00	0.00	0.00	0.00	0.67	0.33	-	0.00	-
Offer 10	0.20	0.80	1.00	0.50	0.00	0.33	0.50	0.25	0.33	0.17
Offer 20	1.00	0.33	0.50	0.67	1.00	0.33	1.00	0.60	0.83	1.00
Offer 30	0.50	0.75	0.50	0.67	0.71	0.50	0.83	0.33	0.40	0.83
Offer 40	1.00	0.45	1.00	0.67	0.25	0.83	0.56	0.67	0.50	0.75
Offer 50	0.97	0.88	0.82	0.94	1.00	1.00	1.00	0.89	0.95	0.95
Offer 60	1.00	1.00	1.00	1.00	1.00	0.83	0.67	0.83	1.00	1.00
Offer 70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Offer 80	1.00	1.00	1.00	1.00	1.00	1.00	-	1.00	1.00	1.00
Offer 90	-	1.00	1.00	1.00	-	1.00	1.00	1.00	1.00	-
Offer 100	1.00	1.00	0.83	1.00	1.00	1.00	1.00	1.00	1.00	1.00

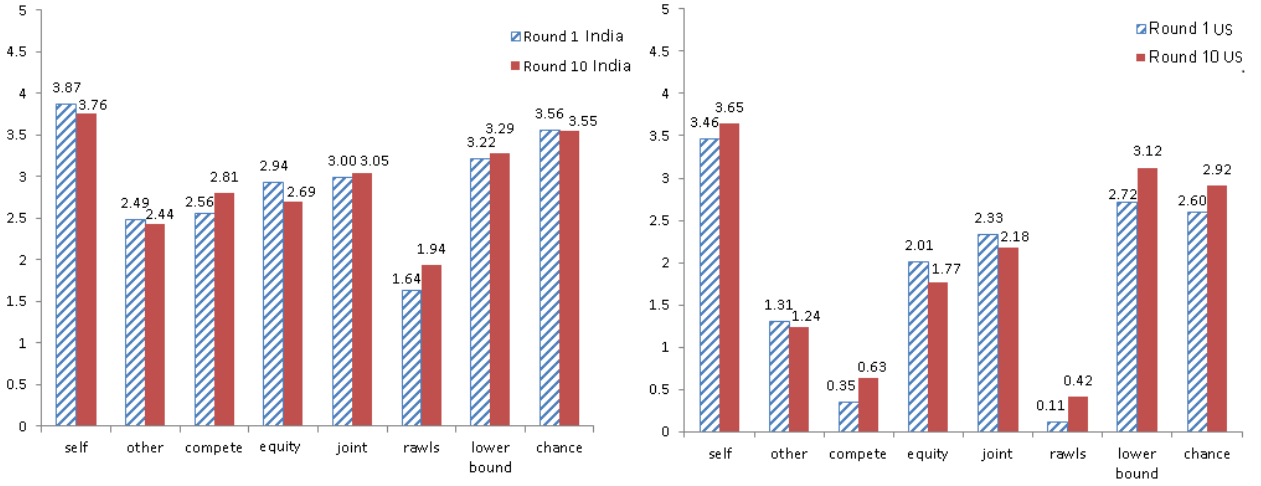

Fig. 2. Comparison between US and Indian average of the reported importance on the 8 criteria in MARV survey in the first and last rounds of the Ultimatum game.

The standard deviations for the offers made by US players are: 12.61, 14.16, 14.25, 14.35, 13.90, 17.06, 15.91, 15.53, 15.52, 16.60. Average offers for the Indian players in the ten rounds of the game are: 47.36, 45.66, 53.40, 45.28, 49.06, 48.30, 46.04, 47.3, 46.98, 49.25. The standard deviations for the offers made by Indian players are: 20.57, 21.76, 24.34, 24.92, 22.26, 24.78, 23.01, 21.82, 24.23, 22.56. The standard deviation is higher for the Indian offers across all rounds.

Figure 2 shows the comparison of the average of the reported MARV values by the US and Indian players in the first and last rounds. The average values reported at the end of the first and tenth round are shown in figure 2 and according to this measurement the values remain consistent throughout the interaction. However, the reported MARV values in the first round are significantly different between the two cultures for all the values except "Self" according to the t-test (p-value <0.05). T-test also shows that for the reported values in the tenth round all values except for the "Self" value are significantly different from one culture to another (p-value <0.05).

4.2. Centipede Game

As described in section 3, the Centipede game continues between the two players until one of the players decides to "take" the bigger pile for himself. If no one takes the bigger pile, the players end up with nothing. In this game, the canonical assumption would predict that the players would take the big pile in their first round of the game.

Figure 3 demonstrates how the US and Indian players performed in our game by showing what percentage of the games ended in each round. 62% of the Indian players took the pile in the first round of the game, as would be predicted by the canonical assumption; however this was done by only 28% of the US players. The average length of the game for Indian games is 1.63 rounds whereas the average length of the game for US games is 2.66 rounds.

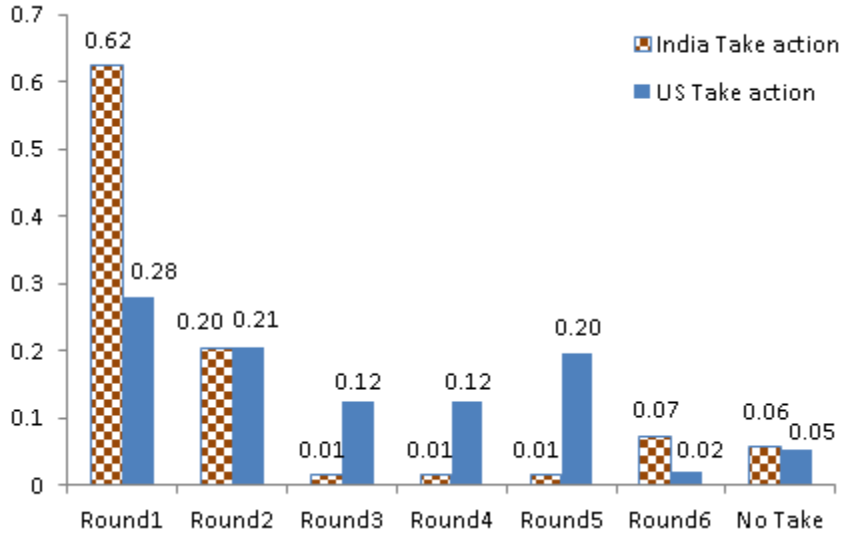

Fig. 3. The relative frequency of the number of "Take" actions per round for US and Indian players.

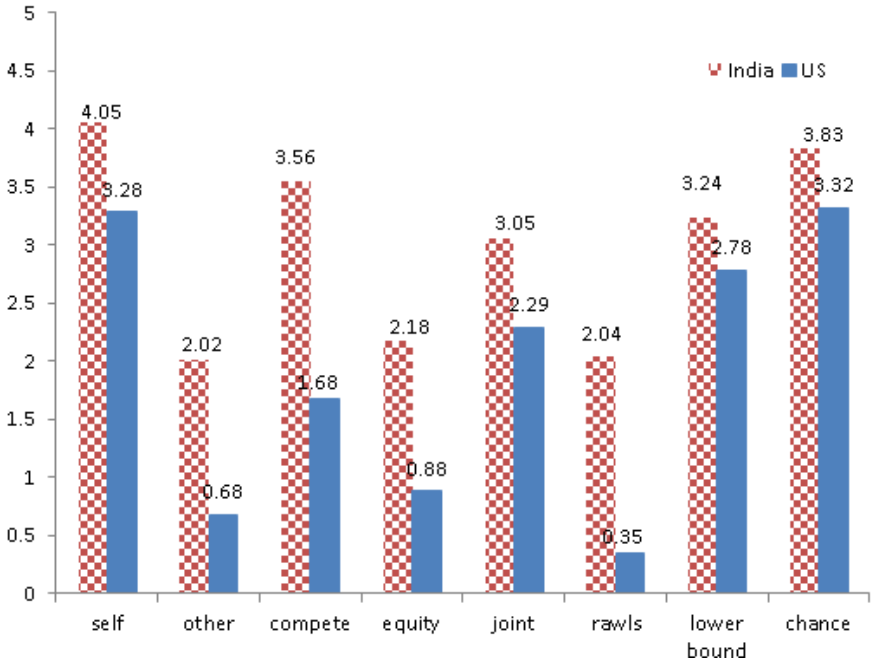

Fig. 4. Comparison between US and Indian average of the reported importance on the 8 criteria in MARV survey in the Centipede game.

Figure 4 shows the comparison of the average of the reported MARV values by the US and Indian players in the Centipede game. The reported MARV values for the following dimensions are significantly different between the two cultures according to t-test (p-value<0.05): the "Self" value, the "Other" value, the "Compete" value, the "Equity" value, the "Joint" value "Rawls" value and the "Chance" value. We see the same pattern of differences between US and Indian players as in the Ultimatum game, however there is more variance in average scores than between the first and last round of the ultimatum game. In particular, Indians report caring more about competition and less about other and equity in the Centipede game than in the Ultimatum game.

5. Conclusion and future work

In this paper we have contrasted US vs Indian Mechanical Turk participants, in terms of both how they play games that allow for both cooperative and competitive aspects, and how they report their values for such interactions. In terms of the behaviour in the Ultimatum game most people tend to offer about 50% to the other side of the interaction, but the ratio of 50% offers is higher among US players than among the Indian players. The offers for each round in both populations follow a normal distribution. Significant cultural differences are observed in the answers to the MARV survey questions. This might imply that either the individuals within the two cultures are different in terms of the degree of importance that they assign to the MARV values.

This paper presents the initial analysis of the result of our experiment which is done on the population scale. In our next step we investigate the relationship between the reported values of each individual and their decisions in the two games. We are also interested in crafting a policy for an agent to play according to the data that we collected for the two cultures.

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