

Cultural Difference on Team Performance Between Chinese and Americans in Multiplayer Online Battle Arena Games

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Abstract. This paper studies cultural difference on team performance in a multiplayer online battle arena game called Defense of the Ancient 2(DOTA2). 37 international competition replays are acquired from the game platform of DOTA2 between Chinese teams and American teams. Though observing the replays, seven variables are brought up and paired data for each variable is obtained. Non-parametric test methods have been used to analyze the data, such as Wilcoxon test and Mood test. The result indicates some cultural differences in online games between two countries' teams as following. Chinese teams are risk-avoiding while American teams are risk-taking. In addition, American teams show potential stronger masculinity than Chinese teams.

Keywords: Cultural difference · Multiplayer online battle arena game · Teamwork · Performance · Uncertainty avoidance

1 Introduction

Playing online game is a popular entertainment in recent years. Millions of people play online games every day and a variety of game-playing behaviors are produced in them. For instance, many guilds are set up in World of Warcraft(WOW), an massive multiplayer online role-playing game. It's interesting to study how guilds generate in online games and if every guild has its particular organizational culture. In addition, it is also meaningful to study whether the team performance is affected by the culture of the players in some real time strategy games like defense of the ancients 2(DOTA2) and whether different cultures will contribute to different results. The findings in online games can help to improve game design on one side. Meanwhile, they may be applied to organizations and enterprises in the real world to improve organization performance on the other side.

Thus cultural difference in online games is an important subject worth being studied, but few researches have been done in this field. While most of the cross-cultural studies focus on realistic society, there have been relatively few cultural researches into the virtual world like online games. And most of the

studies on video games are carried out by questionnaire survey, which can't fully reflect reality. In a unique perspective, this paper compares the cultural difference between Chinese teams and American teams just using the data from a multiplayer online battle arena(MOBA) game called DOTA2 itself.

DOTA2 is a 5v5-player game which is in the dominant position of MOBA games together with another game named league of legends. It provides a platform for game players around the world to interact with each other and enjoy the games without boundaries. Each player controls an in-game avatar and the only victory condition is to conquer the opposite sides main building for each team. One game lasts about 40 min–60 min in common and includes many strategic elements, varying from teamwork to individual operation. In some sense, DOTA2 creates a simulated reality for the players. Every professional team has its unique characteristics in these strategic elements and shows a distinct style. Therefore it is an interesting scientific problem to examine how the performance of professional teams from different cultures shows in Hofstede's five cross-cultural dimensions [6]. According to his theory, cultural differences are elaborated from five different dimensions which are power distance, collectivism/individualism, masculinity/femininity, uncertainty avoidance and long-term/short-term orientation. Furthermore another motivation of this research is whether the result in online game is the same as the conclusions of realistic society.

This paper takes a case study using the combat data of the international DOTA2 championships held in Seattle, July 2014 (TI4). TI4 is one of the biggest electronic sports tournaments all over the world. Among all the matches in TI4, 37 matches between Chinese teams and American teams have been screened out and seven groups of paired observational data have been obtained. Using non-parametric methods, the test result indicates teams from the two countries show different behaviors in cross-cultural dimensions like uncertainty avoidance and collectivism.

The purpose of the research is to explore whether there are cultural differences on online game behaviors between teams from different countries. At the same moment, another purpose is to make clear of the cultural differences and examine whether the differences are the same both in the virtual and realistic world. This paper pioneers a new way to study cultural differences. The findings of this research is a supplement of the cultural research in realistic society. It stretches our attention of cultural differences into the virtual world and help us have a better cross-cultural understanding.

2 Literature Review

There are massive studies on cultural differences, but little research has been done from the viewpoint of online games. The previous research has tended to compare cultural differences between different organisations or nations in the realistic world [9, 15]. Shane Scott studied uncertainty avoidance and the preference for innovation championing roles [14]. Zigang Zhang has made a comparison

between America and China by applying the cultural dimensions of Hofstede in 2004 [20]. However, cultural differences in the virtual world like online games have not been deeply studied.

From the point of online games, research is also focused on aspects like influences of game addiction, demographic factors of the players, game design and so on. There is also little research about cultural differences reflected by the performance of game players. Most of the early studies on online games have tended to concentrate on the more negative aspects such as excessive play and addiction, the medical and psychosocial consequences [1, 2, 10, 18]. And research in this field continues as time goes on. An article verifies that gaming addiction is currently not a widespread phenomenon among adolescents and adults in Germany [3], which indicates people's understanding towards online games is becoming deep and mature. Then the research point turns to motivations, demographic factors and some playing variables of online game players [4, 16, 19]. An online questionnaire survey was used by Griffiths to examine basic demographic factors of online computer game players who played the popular online game Everquest. The result gave a detailed description of the game player on demographic aspects such as gender, age, frequency and so on. At the same year, a comparison of adolescent and adult gamers was made [5]. The researches above are focused on the influence of online games or the demographic factors of game players. Relatively little research has study the behaviors of the players in the game.

Latest research starts to examine aspects of organizational behaviours. The social life of guilds in world of Warcraft has been studied [17]. In keeping with current Internet research findings, players were found to use the game to extend reallife relationships, meet new people, form relationships of varying strength, and also use others merely as a backdrop. Tinnawat has taken a research of the leadership development in DOTA [12]. In the study, multinomial logistic regression and factor analyses have been done using questionnaire data. Based on the findings, it is concluded that players characterized as different game roles show different leadership styles. Ratan Rabindra has studied the gender embodiment in virtual spaces [13]. This article examines the pattern of behavior in League of Legends (LOL) which is another popular MOBA game similar to DOTA2. The results indicate that male players tend to focus more on combat activities while women focus on more social game activities. The general claim has also been supported that males tend to have an instrumental relationship with their avatars, while females tend to have an identity-relevant relationship. Social networks in multiplayer online games are also a hot area of research [11]. His research has addressed the problem of how to extract and analyse the implicit social structure in networked games such as DOTA and StarCraft series. Some interesting researches on online games also involve gender culture and collective culture [7, 8]. Behaviors of players who choose the opposite gender in online games have been studied. The result shows men overcome their inhibition for help seeking when using female avatars.

In conclusion, more and more articles begin to study organizational culture in online games. But there are few researches conducted on cultural differences and cross-cultural factors. Besides studies on culture in online games are fragmentary lacking systematic carding.

3 Data and Method

3.1 Variables

As a real-time strategy game, DOTA2 contains massive equipment and props ranging from assault weapons to healing salve for avatars, which leads to a series of complicated attacking and defending performance. In the game, it is essential to have a good teamwork if one side wants to win the game. There are several items for the team in DOTA2 which are used almost in every game. For instance, smoke of deceit is an item used for a sneak attack. Upon activation, the user and all nearby allied player-controlled units gain invisibility and bonus movement speed for a brief time. Minimap icons will also be hidden. Upon moving within 1025 range of an enemy hero or tower, the invisibility is lost. The duration of smoke of deceit is 35s. Due to the function of smoke of deceit, it can be concluded that one team will gain a greater chance to kill the enemy heroes with this item. In some sense, a team is more aggressive and challenging if using smoke of deceit under a higher frequency than the other side. Thus the gender role of this kind of team is close to masculinity and the opposite team is relatively close to femininity applying the cultural dimensions of Hofstede. Another common item is ward. There are two kinds of ward, observer ward and sentry ward. Observer ward provides a broad perspective while sentry ward produces an invisible ward capable of spotting invisible enemy units, but lacking in vision. A team shows strong uncertainty avoidance if using observer wards and sentry wards frequently. In addition, runes are powerful items player can obtain with his avatar that vanish when they are picked up, and give the avatar a powerful effect for a limited amount of time. Every even numbered minute of game time, starting at the first creep spawn, a rune will spawn at one of the 2 rune spawning locations, if there is not already a rune at one of the spawning locations. Each spawning location is in the river, one of them is northwest of the middle of the map, and the other is southeast. Frequency of activating runes also shows uncertainty avoidance of a team.

According to the common items and common performance of the players in the game, seven variables have been brought up that can reflect cross-cultural dimensions. The first two variables are the frequency of kill by one player and the frequency of kill by multiplayer which show individualism and collectivism of a team. The following two variables are the frequency of picking fight and the frequency of using smoke of deceit which show the gender role of a team. The last three variables are the frequency of using observer ward, the frequency of using sentry ward and the frequency of activating runes, which reflect uncertainty avoidance of a team. Through making a comparison of two opposite teams upon

these seven variables in each game, it can be tested whether cultural differences exist between teams from two different countries.

3.2 Procedure

From DOTA2 platform, 37 game replays have been acquired as our research sample between Chinese teams and American teams in the fourth international DOTA2 championship which is a top electronic sports tournament held every year from 2011. Observational data of seven variables is obtained in every replay. Table 1 shows the data observation standard. Each data is a cumulative value during one whole game.

Table 1. Data observation standard

Item	Observation standard
Frequency of kill by one player (KO)	Observe the death of each avatar. If the source of the damage is from one enemy avatar, frequency of the enemy side adds one
Frequency of kill by multiplayer (KM)	Observe the death of each avatar. If the source of the damage is from more than one enemy players, frequency of the enemy side adds one
Frequency of picking fight (PF)	Observe each fight. If avatars of one side launch attacks first, frequency of the corresponding team adds one
Frequency of using smoke of deceit(SD)	When one side uses smoke of deceit, frequency of the side adds one
Frequency of using observer ward (OW)	Count the times of using observer wards which are solid dots in minimap
Frequency of using sentry ward (SW)	Count the times of using sentry wards which are hollow dots in minimap
Frequency of activating runes (AR)	Observe rune spawning locations every even numbered minute of game time. If an avatar activates the rune, frequency of the corresponding team adds one

There were 16 top teams which consisted of five professional players in each team from all over the world attending TI4. Thus the performance of the players is representative of their own culture without the interference of inexperience. As the observation is completed, seven groups of paired data are acquired. Then median tests and scale tests have been conducted under each variable using non-parametric methods like Brown-Mood test, Wlixon test, Siegel-Turkey test and Mood test. The software we use is R language.

4 Results and Discussion

4.1 Basic Description of the Data

From 37 game replays, seven groups of paired data are acquired via observation. The basic statistic analysis of the data is as following in Table 2.

Table 2. Basic analysis of the data

Variable		Mean	Median	Std	Min	Max
KO	China	2.41	2	2.47	0	9
	USA	2.27	2	2.33	0	9
KM	China	16.57	16	8.45	4	42
	USA	16.70	19	10.43	1	42
PF	China	9.84	9	4.79	2	27
	USA	10.89	10	5.61	2	23
SD	China	3.57	3	1.97	1	9
	USA	3.30	3	2.12	0	7
OW	China	10.38	9	4.93	4	26
	USA	9.65	10	4.30	2	18
SW	China	7.49	6	5.92	0	23
	USA	4.46	3	4.39	0	18
AR	China	9.59	9	4.32	4	20
	USA	7.49	6	5.18	2	25

Basic statistic shows that Chinese teams and American teams have approximately same mean value of three variables which are KO, KM and SD. The remaining four variables especially SW and AR have unequal mean value between two countries’ teams. From the viewpoint of median, the result is a little different from that of mean value. Median is the same of only two variables which are KO and SD. While median of KM exists relatively a large gap between Chinese teams and American teams, significantly different from the result of mean value. The reason of the difference is that mean value is sensitive to outliers while medium is relatively steady. Thus medium is a better index to explain the performance difference between two counties’ teams. In addition, standard deviation has a relatively big difference in four variables which are KM, PF, SW and AR. The remaining three variables have nearly the same standard deviation.

To sum up, Chinese teams use more observer wards(OW) and sentry wards (SW) while American teams pick fights more than Chinese. These are preliminary conclusions. Further analysis should be done to test whether the differences above indeed exists. For each pair of observational data, median tests and scale tests will be conducted in the following. In the analysis process, non-parametric methods like Brown-Mood test, Wlcoxon test, Siegel-Turkey test and Mood test are used.

4.2 Non-parametric Test Result

Table 2 indicates that Chinese teams and American teams may have differences in some variables like PF, SW and AR. In this part each pair of observational data will be tested. Among the four test methods, Brown-Mood test and Wlicoxon test are used to examine whether the medians of paired data are the same. Siegel-Turkey test and Mood test are used to verify whether the scales of paired data are the same. Based on the test result comparison can be made of the team performance between Chinese and American teams. Table 3 shows the test result of each variable.

Table 3. Median test and scale test

Test method		KO	KM	PF	SD	OW	SW	AR
Median test	Brown-Mood	11	17	17	18	17	20	21
		(0.82)	(0.64)	(0.97)	(0.24)	(0.89)	(0.02**)	(0.03**)
	Wlicoxon	703.5	680.5	608.5	731.5	720	917	908
		(0.84)	(0.97)	(0.41)	(0.61)	(0.70)	(0.01**)	(0.02**)
Scale test	Siegel-Turkey	1437.3	1549.6	1549.2	1462.9	1345.3	1440.8	1558.6
		(0.62)	(0.08*)	(0.09*)	(0.38)	(0.69)	(0.59)	(0.06*)
	Mood	-0.226	-2.028	-1.876	-0.873	0.086	-0.524	-2.172
		(0.82)	(0.04**)	(0.06*)	(0.38)	(0.93)	(0.60)	(0.03**)

“*” indicates significant difference at 10 % level.

“**” indicates significant difference at 5 % level.

From the test result, Chinese teams and American teams are significantly different in the scale of KM and PF. The frequency of using sentry wards is also different between two countries teams at 5 % significant level. In other words, Chinese teams use more sentry wards than American teams. As for frequency of activating runes, median test and scale test are both significant. Chinese teams activate more runes than American teams in one game. Different from the preliminary conclusions, frequency of kill by multiplayer is not significantly different in median. To make a visualization of the test result, probability density plots of seven groups of data are drawn in Fig. 1.

Graphical results back up the median test and scale test. In Fig. 1, the red solid lines are probability density distributions of Chinese teams, while the blue dashed line are probability density distributions of American teams. It is obvious that scale difference exists in the second, third and last sub-figures, because the steepness of the two lines are not the same among which one is steep while the other is relatively gentle. In addition, position difference exists in the sixth and last sub-figures, because peaks of the two lines are stagger. Due to these results, cultural differences can be concluded in relative cross-cultural dimensions, which will be discussed in the last part of the paper.

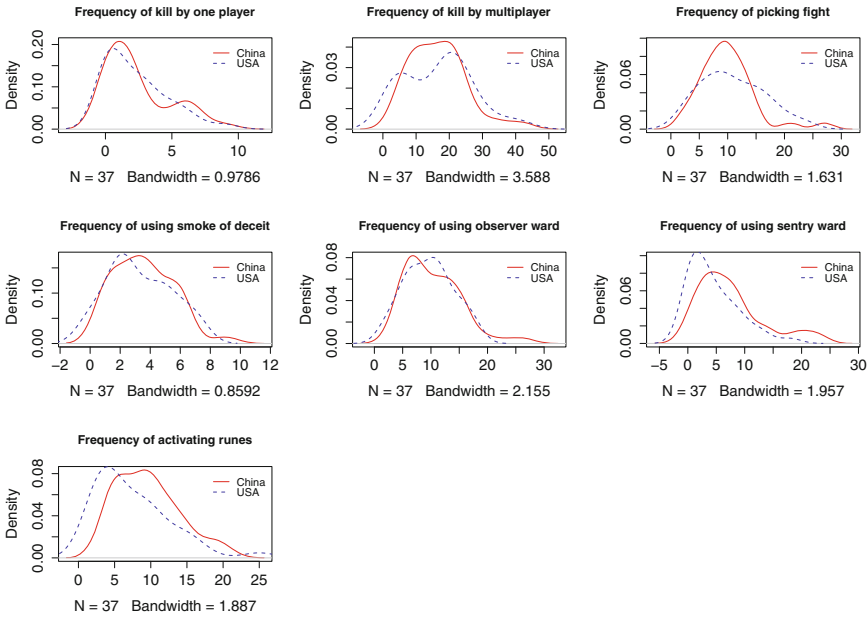


Fig. 1. Density plots of seven groups of data

4.3 Discussion

Through analyzing the data, there are mainly two conclusions of this research. Firstly, in the cross-cultural dimension of uncertainty avoidance, Chinese teams show stronger uncertainty avoidance than American teams which is clarified by the test results of SW and AR. It shows that Chinese teams activate more runes and use more sentry wards which is used to spot invisible enemy units. These performance can help the team reduce risk of a sudden attack from the enemy side. But American teams activate relatively fewer runes and use fewer sentry wards. Thus it can be seen that Chinese and Americans hold different attitude towards uncertainty in DOTA2. Chinese teams are of risk aversion and take measures like using sentry wards to avoid uncertainty. On the contrary, American teams show relatively weak uncertainty avoidance.

As for frequency of using observer wards, it is also a target to reflect uncertainty avoidance. But neither the median test nor the scale test is significant, which seems in conflict with the test results of SW and AR. Actually this phenomenon is reasonable. Because the observer ward is an item that can prevent sudden attacks on one side, on the other side it can be used for detecting the enemy avatars and making an active attack. So frequency of using observer wards is an aggregative variable of several cultural factors. This is why it's not significant in median test and scale test.

Secondly, American teams show potential stronger masculinity than Chinese teams. The test result indicates that scale of PF is significantly different between

two countries' teams. Picking fights is a challenge and offensive behavior which is an aspect to reflect masculinity of a team. From the third sub-figure in Fig. 1, American teams have a higher probability to pick fights when the frequency is greater than 15, though median difference is not significant. Due to Hofstede's theory, challenge, earnings, recognition, and competition are important in masculine societies. The result in the third sub-figure means that American teams may be relatively more competitive and masculine. Further studies can be done to verify this conclusion. Lastly, in the dimension of individualism and collectivism, there are not any big differences between Chinese teams and American teams.

5 Conclusions

The conclusions of cultural differences between Chinese and Americans in MOBA games are similar to the conclusions in the realistic society which is studied by Zigang Zhang [20]. In his research, Americans are risk-taking while Chinese are risk-avoiding. And in the dimension of masculinity and femininity, Americans show medium masculinity while Chinese show medium femininity. These conclusions are consistent in this paper. However, Zigang concluded that Americans show strong individualism while Chinese show strong collectivism which isn't embodied in our research of DOTA2. This paper compares cultural difference in an online game called DOTA2 which comes up with a new perspective to study cultural difference. It stretches our attention of cultural differences into the virtual world and help us have a better cross-cultural understanding between Chinese and Americans. Besides, the research findings can be taken into account in game design and development to provide the game players with better game experience. Further research can be done to find out more variables and conduct a test of the remaining two dimensions of cultural difference which are power distance and long-term orientation.

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