Game Refinement and Utility-Fun Function: Application to Card Games

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Abstract: The Games should be fun to play for all the players irrespective of the level of expertise. The Game refinement studies about the same attractiveness to play the game. In this paper it is complimented by the approach of Utility to make Naive games more exciting for the players. The entertainment aspect is further enriched by complementing with Utility. The human bias developed due to cognitive frame is discussed which judges the game play and affects the entertainment factor of play thereby, which is not a case for computer simulated players. The thoughts and physics in human mind are analyzed for it.

Keywords: Game Refinement, Utility, 3Card Poker, Multiplayer incomplete information game, Human Bias in Game

1. Introduction

The Games are a part of every human’s life in the world. The Games can be of different types based on complexity and time play. There are many games which are simple with naive game play, not involving complex rules and tactics of play. But the problem with such shorter games is that they tend to become boring after playing for a while and when the players are expert and expect more challenge. But such novice and naive games are important because if game is not playable among beginners it can never be developed to a popular game. So a consideration is made to study development of such games in this article.

This paper is organized in following sections: II. Naive games and Human Bias, describing situation of human tendency towards short-simple novice games. III. Game Refinement and Utility, describes the approach for adding the Utility-function to the idea of Refinement along with the principles of pre-existing Refinement theory. IV. Case Study of Card Game, depicting the game play of a very simple 3Card Poker and a model of evaluation of Utility-Fun function. V. Conclusion, giving the ending remarks of the composition.

2. Naive games and Human Bias

In short-naive games which tend to be boring after a while and are not enough challenging, with nothing at stake of players, at one stage person knows it will not matter if he wins or loses and he will not be any different, and so he takes it for granted to play the game. The excitement (adrenaline rush!) is possible only if he knows he is taking risks at stake, it will be adventure for him and each player will try as much as possible to win and this will create a healthy competition and fairly entertaining game for all.

For an instance, consider a case of parents playing a game with their children, the child is neutral and does not have any idea of utility and hence it is a neutral player (playing with all possible hard inputs to win). The parent on the other hand knows that it will not find him any ‘utility’ or serve any purpose if he win or lose the game, and hence be less interested in the game. The child being the neutral player find much more fun in the game compared to the parent, who on other hand will not be that entertained because he is not playing with any risks (to give him adrenaline rush), in short some ‘utility’. It could be more fun for both the players if both play with all possible efforts and this bias is removed. In the later part of this article we depict about a simple card game.

This also happens when the players are not of the same expertise, the expert players underestimates the amateur player in the game and taking it for granted, will not play with all possible capabilities and strategies which he would do against any expert player, and hence he will not have the fun he could have by playing neutrally with all efforts. And also the other players Enjoyment factor (Individual Game refinement value) will be affected due to it. This will not be an aspect under consideration when we consider only artificial simulating players like amateur, defender, offensive player, expert player because it will not have a humane factor which can judge other players with cognitive prejudice and thinking, and develop such a bias [1].

This will be a more often case in the ‘non-seesaw games’ where the games tend to be one-sided or biased based on human prejudice. So in order to make them seesaw and make
them more interesting there should be some modification in the game play to add to the excitement and fun part, say some utility part. This can be developed in a utilitarian approach of the Game theory.

3. Game Refinement and Utility

The game theory by Nash [6] is used to study the game play. Later the Game Refinement Theory by Iida et al [3][4] studies the entertainment and intelligence part of the Games. By the current concept a focus has been laid to also account for a utility gain by addition to the game refinement aspects. The approach followed to understand the game progress and determine the more exciting and entertaining parts of the game are crux of refinement theory [9]. As described in previous section regarding the situation of naive games, we propose more refinement of these games by implementation of a new concept of utility which is about the practical gains in addition to the enjoyment one can get from the game.

One feasible refinement is keeping something at stake, some bet to be placed by players, and winner gains and loser loses, to give human a factor to be interested in the game all the way till end. This risk factor induces a feeling of excitement and a natural feeling which one seeks when looking for entertainment and fun. This should not be taken in sense of gambling but it can be considered as the cost of playing [2] and prize on winning and should be taken in regard of the rewards. The game will be balances and zero-sum as the usual games are, so one player gains utility but other loses it. But the entertainment got by playing the game is fun for both the players, over and above utility. A new function giving a measure of the likelihood to player to play the game can thus be defined by accommodating factors of entertainment, excitement and utility.

Here we are taking example of the POKER type game. So we propose refinement of these games by implementation of a new concept of utility which is about the practical gains in addition to the enjoyment one can get from the game. It can also be demonstrated by illustration of Rock-Paper-Scissor Game. It is a fun and interesting game to play, but usually it is played with something at stake, to come to a random decision of distribution which favors winner. But if it would be played without anything at stake, it will be totally boring in just few plays. Similar is case of Tic-Tac-Toe Game. It is played as a naive but some such element of utility can be introduced in it to make it more appealing to all players. (May be something like some stake to bet at every move of player, which will avoid thoughtless moves and increase excitement.)

4. Case Study of Card Game

4.1 3 Card Poker Game Play

The Game is multiplayer, played in set of many game plays. A single play round of this game is very short and so they are played in multiple rounds, so this makes it quite longer enough to be enough entertaining, challenging and competitive (giving players enough chances to win if they could not win in previous rounds. (Even then victory is not guaranteed!!)). So it can be considered to be a step-wise game. The game is played using an international 52 card pack with reasonable number of players. The game play without any betting is just simple based on highest card rank combination wins. But it becomes so naive without involving the stake pot that it will soon be boring. There are different versions of the game with minor variant in some rule.

The players are dealt 3 cards each in the beginning and that’s all. Then the player to the right of dealer has turn to choose to continue in game(usually with a bet) or fold, and then it goes in a circular fashion for as many rounds till either all players (except one) folds or anyone player asks for the show by bidding the amount of ongoing stake. Then the hands are compared and the person with the highest rank wins. Also it is to be noted that if you havent seen your cards then you are called a blind player and a blind has to bet the half of the current ongoing stake amount. The ranking of card is (highest to lowest) - A K Q J 10 9 8 7 6 5 4 3 2 and the ranking of hands is as follows (Highest to lowest):

- Three of a Kind (A A A)
- Straight Flush (4 5 6 of same suit)
- Straight (5 6 7)
- Flush (same suit cards)
- Pair (A A 4)
- High Card (A 9 J)

But this game play does not induce any more excitement factor with just naive game play. In order to make it more
interesting there is involvement of keeping something at stake and with every decision of the player to continue in play he has to bid an amount. So this will associate his risk and hence this total dedication towards the game play. Thus making it more interesting, fun and exciting compared to simple-naive game play.

Table 1 The probability of different hands winning and their odds

<table>
<thead>
<tr>
<th>Hand Type</th>
<th>Frequency of Occurrence</th>
<th>Probability of occurrence (%)</th>
<th>Odds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three of a Kind</td>
<td>52</td>
<td>0.24</td>
<td>224.1</td>
</tr>
<tr>
<td>Straight Flush</td>
<td>48</td>
<td>0.22</td>
<td>459.42:1</td>
</tr>
<tr>
<td>Straight</td>
<td>720</td>
<td>3.26</td>
<td>29.69:1</td>
</tr>
<tr>
<td>Color</td>
<td>1096</td>
<td>4.96</td>
<td>19.16:1</td>
</tr>
<tr>
<td>Pair</td>
<td>3744</td>
<td>16.94</td>
<td>4.90:1</td>
</tr>
<tr>
<td>High Card</td>
<td>16440</td>
<td>74.39</td>
<td>0.34:1</td>
</tr>
<tr>
<td>Total</td>
<td>22100(52C3)</td>
<td>100.00</td>
<td>0.00:1</td>
</tr>
</tbody>
</table>

4.2 Utilitarian Aspect

For making a Game progress and information progress model, we consider the thought like number of hands won against total number played. The utility associated with different game plays will be different, hence that should also be taken into the account.

Some fundamental points taken in consideration for formulation the model are:

1. Excitement level will be more when there is possibility of more gain [8]
2. The more the uncertainty of game outcome, more will be the entertainment. [5]

Excitement level will be more when there is possibility of More gain. (* This states that the refinement factor varies directly as pot amount), Or More possibility of gain (# This will be used in probabilistic approach in measuring utility factor). So if the amount of pot increases then there should be more excitement in the mind. As it is assumed with the force in mind concept that there is more force in mind as the information of more probable gain is increased. So if the probability of winning increases the excitement also increases. Also consequently the risk factor is more on the same hand (as player has made a large bet too), this will also ensure that the each player will play with the total abilities, resulting in a more refined game play.

The more the uncertainty of game outcome, more will be the entertainment. (** This fact will be used in formulating the enjoyment factor). And in the case of 3Card Poker the outcome is totally uncertain between the existing players in the game until everyone shows their all cards, which marks end of the game. The game information about outcome progresses as the game progresses and different players FOLD and quits the play. Then the outcome becomes less uncertain (in terms of winning probability but totally uncertain in terms of progress) hence the raise in entertainment factor will decrease in subsequent round, but it will add to the value in previous rounds. The probability of winning of the rest of the players increases then, hence raising the utility part. So we can formulate a utility function based on this scheme of winning chances and it can be merged with the entertainment part and form a new index of refinement.

So for measuring the enjoyment factor of each player we can model it as follows:

- At end of each round in a game, the value of entertainment \(X\), is assigned to each player as \(X(\text{newround}) = X(\text{PreviousRound}) + n \times c/N\) : where \(X\) is entertainment factor. \(n\) is number of players in present round, \(N\) is total number of players from beginning, \(c\) is a constant factor. (** can be directly related to the jackpot amount raised in the round. From * and **)  
- Again in next round new values will be assigned, (replacing the previous ones) based on number of players left in that round. This value will always increase for the players in game, as the number of players will decrease further. It is also compatible with fact that the players who play till last have most fun.
- When anyone quits his entertainment value fixed to the value which was last assigned value.
- These values can be normalized later to adjust to a proper factor and merge with utility factor.

Normalization of entertainment factor:

\[
x = \frac{X}{X_{\max}} \quad \text{where} \quad 0 \leq x \leq 1
\]

\(x\) is (normalised value of entertainment factor); \(X\) is (individual player entertainment factor at end) \(X_{\max}\) is (maximum \(X\) from all players).

The measure of Pot amount gained gives a quantification of the utility. But it has to be normalized to a proper factor to make an equally quantized Utility-Fun Function.

Normalization of utility factor:

\[
u = \frac{M}{T} \quad \text{where} \quad 0 \leq u \leq 1
\]

\(u\) is normalized utility factor; \(M\) is the amount gained by the player ; \(T\) is the total bet placed in the entire game set by all players.

The empirical Utility-Fun Function can be formulated as: \(F = \frac{\lfloor x + u \rfloor}{2}\), with range of values in \([0 \text{—} 1]\). This Utility-Fun function will give a measure of the likelihood of player to play the game, as he gains enjoyment and also some material utility gain from playing it.

In order to calculate the utility of any player while the ongoing game play, it can be assumed by probabilistic gain approach. (For instance if there are 3 players in the game we can put \(u = 1/3 \times M/T\); \(M\) is the pot amount in current game and \(T\) is the total bet till now in entire game set.) But it will account for uncertainty in it which will remain till the end of the game.

5. Conclusion

From the present work we find how the too simple naive games can be made enjoyable and more exciting to play in a series by adding a part of ‘utility’ to it. The newly formulated Utility-Fun function is also a good measure of players tending to like to play the game. Although these games are
well refined in their own way, but addition of an utility aspect is something more which keeps the player involved in the game with all interest. Although the utility can be explicitly different in different games, so in future works, the utility-fun function can be worked out to make a generalized formula instead of an empirical one used here.

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References

[8] J. E. Roller, James Rollerfs Vintage Amusements. URL: http://www.jamesroller.com/history/. Accessed: 24-06-2014. (Carnival game specialist James Roller mentions the percent chance of receiving a prize as being the most significant for player enjoyment, followed by the quality of merchandise per cost of playing)