

## An Optimum Strategy for Bliss in Life

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### Abstract

*Game theory presupposes that there are at least two players with conflicting interests and the outcome of the game depends on the decisions of all the players, while the decision theory presumes that the decision of only one agent affects the outcome because the decision maker has to reckon with only a passive environment. Here, we treat life as a game with the human being on one side and the Nature on the other. Using the results of the game theory, it is shown that an optimum strategy for life is: "Do thy duty, reward is not thy concern"*

### Introduction

Since times immemorial, philosophers have been struggling to unravel the mysteries of life and death. "What is life, what is its purpose, what was before life and what will be after death" are mind boggling questions and as of today, their answers seem to be as far away as they were on the day one of the universe (if it at all was). Honestly, I am too small a fry to claim final answer to such riddles. However, mine is a humble attempt to explain same ideas in the light of modern game theory which has found wide applications in business, economics, warfare and many other competitive situations of conflicting interests (Gupta, 2008).

What is a game? As someone defined (Neumann, & Morgenstern, 1944), "A game consists of moving objects on a surface according to certain rules." This, however, is too restrictive a definition. Games in game theory are very rich in variety with no restrictions at all as to their external characteristics. They may be played on a table, by telephone, on T.V., in a conference room, in the battle field, or in the bed. Games may or may not be for stakes. A game requires at least two persons (called players) with conflicting interests. Thus, wage negotiations between the workers' union and the management, advertisement war for market share between Pepsi and Coca Cola, the disarmament talks and the war itself are all seen as games (Davis, 1983; Meyerson, 1991; Hillier, & Liberman, 2005).

### Terminology of Game Theory

Games are decision problems between two or more players with conflicting interests. Each player has several moves or courses of action (called strategies) open to him from

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which he has to choose one strategy for each play of the game to achieve the most favorable result. However, the outcome of a player's action depends also on the actions of the other players. Thus, there is an element of "interdependence." Things are further complicated because no player knows what actions the other players intend to take and in fact they make all efforts to hide their intentions. So each player has to take decision under imperfect knowledge. Hence, there is also an element of "uncertainty" in the outcome of a game. By solving a game we mean to find the choices of strategies for various players which would ensure maximum satisfaction to all players.

Games may be zero-sum or non-zero-sum games. In zero-sum games, the gain of one is the loss of others and the total gain of all players is zero (Hillier, & Liberman, 2005). Thus, in zero-sum games, wealth is neither created nor destroyed. On the other hand, poker in which a certain percentage of the pot is removed for the house before distribution among players is an example of non-zero-sum game. Games may also be cooperative or non-cooperative (Luce, & Raiffa). Cooperative games are those where the players form coalitions and work as teams while in non-cooperative games each player takes his own independent decision. Obviously, two-person zero-sum games are always non-cooperative because the gain of one is the loss of the other and there is no ground of common interest.

Let us consider a simple two-person zero-sum game called the game of matching pennies (Hillier, & Liberman, 2005). There are two players, say A & B, each having one penny. Each player selects either head or tail in his penny without knowing the choice of the other and without letting the other know his own choice. If their choices match (i.e. both heads or both tails), 'A' wins a penny from 'B' and if they do not match (i.e. one head and one tail), 'B' wins a penny from 'A'. This game may be summarized as under:

Table 1, called the payoff table, shows payoffs to the player A. Negative entry means an actual loss or payment by A to B. The game being a two-person zero-sum game, the payoffs to B are the negatives of the payoffs to A.

Table 1

		Player B	
		H	T
Player A	H	+1	-1
	T	-1	+1

### Mixed Strategies

The main essence of this game is secrecy. If one player can guess the strategy of the other player, the latter is doomed. So in repeated plays of the game no player can adopt the same pure strategy again and again. He has to mix his available strategies in such a way that the other player is confused. Suppose 'A' mixes his strategies as head and tail

alternatively (H, T, H, T, ...) or two heads and one tail alternatively (H, H, T, H, H, T, ...). Although, it may confuse B initially but after a few plays, the player B, being rational, is sure to decipher this rule of mixing and then adopt a strategy to hold 'A' down to the greatest loss. In fact, if a player mixes his strategies according to any mathematical rule, the opponent will always decipher it. So, one has to mix his strategies through the process of randomization. For example, suppose a player decides to roll a fair die and if it turns up '6', he shows 'Head' otherwise 'Tail' i.e. he selects H and T with probabilities  $1/6$  and  $5/6$  respectively. This would ensure that no player will be in a position to know the exact move of the opponent in any play even if he knows the probabilities of mixing. These types of strategies are called mixed strategies (Shubik, 1982). The mixed strategies may be  $(1/6, 5/6)$  or  $(1/3, 2/3)$  or  $(1/2, 1/2)$  or any other such combination with total 1. The extreme strategies  $(1, 0)$  and  $(0, 1)$  are pure strategies as they correspond to repeated plays of Head and Tail respectively.

### Expectations of the Players

Suppose A adopts the mixed strategy  $(x, 1-x)$  and B adopts  $(y, 1-y)$ .

If A always plays 'H', his expected gain is:

$$E_H(A) = 1(y) + (-1)(1-y) = (2y-1)$$

and if A always plays 'T', his expected gain is:

$$E_T(A) = -1(y) + 1(1-y) = (1-2y)$$

But, 'A' mixes H and T with probabilities  $x$  and  $(1-x)$  respectively, so his long term expected gain is:

$$\begin{aligned} E(A) &= x(2y-1) + (1-x)(1-2y) \\ &= (2x-1)(2y-1) \\ &= 4(x-1/2)(y-1/2) \end{aligned}$$

This being a zero-sum game, the expected gain of B is just the negative of  $E(A)$  i.e.  $E(B) = -E(A)$ . If  $E(A)$  is positive it would mean a long term gain for A otherwise a long term loss to A (i.e. gain to B). It is called a fair game if  $E(A) = E(B) = 0$ . [3, 6]

Suppose A adopts the mixed strategy  $(x, 1-x)$  with  $x > 1/2$ , then B, being clever, will immediately adopt  $y < 1/2$  so that  $E(A)$  is negative and if A chooses  $x < 1/2$ , then B will immediately switch over to  $y > 1/2$  so that  $E(A)$  is again negative. It is, therefore, obvious that if A wishes to escape defeat, he has no other option but to adopt the mixed strategy  $x = 1/2$ ,  $1-x = 1/2$  so that  $E(A) = 0$  which means that 'A' neither gains anything nor loses anything and the game becomes a fair game with loss to none and gain to none.

### The Game of Life

Now, we shall examine how well this model of two-person zero-sum game fits to human life. Human life is full of actions and at every step we have to decide which one of the various alternative choices of action suits us best. If the outcome of each choice is predictable in advance, the problem of decision making is quite simple as we can choose the action with most favorable outcome according to our criterion of preference. However, the things in real life are not so simple. The outcomes of our actions are mostly uncertain. We have to live and make decisions in the face of uncertainties. Every uncertainty involves risk (which may be statistically defined as long term average loss). Nobody wants to run a risk and yet it is inevitable with uncertainty. We can, however, try to control or minimize this risk by taking the right decision.

Game theory and Decision theory are two approaches for our guidance in decision making. Game theory presupposes that there are at least two players with conflicting interests and the outcome of the game depends on the decisions of all the players, while the decision theory presumes that the decision of only one agent affects the outcome because the decision maker (group or individual) has to reckon with only a passive environment (i.e. he has no opponent). Now, if the environment is passive why are the outcomes of various actions uncertain? Adherents of decision theory claim that it is because the environment itself is impinged with uncertainties due to the presence of random processes which affect the environment unpredictably. Numerical probabilities may be assigned as measures of these uncertainties provided the process is regular and observable. E. G., if my problem is to decide whether or not to take a raincoat while going for a walk, I can assign, on the basis of past observed data, probability of its raining and hence getting wet and take a decision accordingly. It is the phenomenon of regularity which makes the environment passive. However, even with the most regular random phenomenon, we have rare happenings (it may rain even though the probability is very low) which are usually ignored as exceptions.

To me it seems that the uncertainties of life including the so called rare happenings can be better explained if we regard the human life as a game between the human being and the Nature. The events in life are influenced not only by the actions of the human being but also by the strategies deliberately adopted by the 'Nature' through its free and conscious choice. Einstein, perhaps, did not err when he said, "In creating this universe, God did not play dice". So, instead of treating the environment as passive, it is better to treat the environment as an active player. Thus, life is a game with the human being on one side and the Nature (not the passive environment) on the other. Every action of the individual is a play of the game and its outcome is uncertain because the strategy of the Nature is unknown. The game of life is, however, a bit peculiar because the Nature or the Almighty God who is omnipresent and omnipotent knows our strategy though we do not know His.

### Optimum Strategy in the Game of Life

Going back to the matching pennies game let us consider the player A as the individual (human being) and the player B as the Nature. As demonstrated earlier, the optimum strategy for A is  $(1/2, 1/2)$  so that his/her long term expectation is  $E(A) = 0$  i.e. no gain or no loss to A and the game ends up as a fair game. Even a slight deviation from this optimum strategy may provide an opportunity to the opponent (the Nature) to inflict a long term loss on A.

What does this strategy  $(1/2, 1/2)$  mean in relation to the game of life? It is the attitude of equal disposition to gain or loss, pleasure or pain, success or failure, heat or cold and in short, to every pair of opposites. It is what is called, the philosophy of Detached Action (*Nishkam Karm Yog*) (Swami, 2000), "Do thy duty, reward is not thy concern". It is this strategy alone that ensures no loss and no risk to the individual in the long run. It is the master strategy to overcome the impediments of uncertainty. It leads to the mastery of one's own self, to the emancipation of soul and to the state of beatitude and perpetual bliss. Every other strategy, pure or mixed, is replete with risk and attendant losses - physical, mental and spiritual and leads the human being to the state of slavery of ever expanding desires and constant pursuit of the so called pleasures with consequent tensions and miseries which follow as natural corollaries to the non-fulfillment of desires. The master becomes the slave, as the great philosopher saint Vivekanand (Swami, 2001) once remarked: "We came here to enjoy, we are being enjoyed; we came here to work, we are being worked; we came here to sip honey but we find our hands and feet stuck to it." Experiences of our daily life bear testimony to it. We buy machines to work for us but after some time when we have too many machines, we start working for them.

### Frequently Asked Questions

If one is equally disposed of to success and failure, what should he work for: success or failure? The answer again lies in the philosophy of Detached Action itself. One has to engage oneself in the fulfillment of his duty, whatever it is, and forget about the outcome or the result. It is exactly what a soldier does on the battle field. He acts according to the orders of his superiors i.e. performs his duty, without caring for the outcome of the war or the outcome of his own action.

It is the expectation of gain that propels one to action and if there is no expectation of gain what shall be the motivation for performing any action at all? Will it not lead to inaction and lethargy? No, the very basis of these questions is shaky. The facts are just the reverse. The greatest deeds whether in peace or war that man has ever done were accomplished when he not only forgot about success or failure, gain or loss but also forgot his own physical comforts. This is true for all notable achievements in literature, art and science of which mankind may justly be proud of. Be it Newton or Shakespeare or any other great personality, while working on their respective projects, they had no idea that their names would be recorded in history or that the mankind would ever remember them with honor. They could produce such great works because work was

worship for them, work itself was pleasure for them and they were wholly engrossed in performing their pious duty in the areas of their respective interests.

Is there any strategy which may ensure us only gain and no loss?

Yes. The expected gain of A is  $E(A) = 4(x-1/2)(y-1/2)$ .

If  $x = y$  then  $E(A) = 4(y-1/2)^2 \geq 0$  i.e. the expected gain of A is never negative.

Thus, if we can adopt the strategy of the Nature then the expected gain of the individual can never be negative. The very idea of loss is lost in nothingness. The worst possibility in that case is that Nature may itself adopt a strategy with  $y = 1/2$  to hold us down to zero level. However, we should not expect Nature to be so cruel as to choose only the single worst possible value out of a non-innumerable set of infinite values  $0 \leq y \leq 1$ . So, if we want to be sure of long term gain we must put ourselves in tune with Nature by surrendering our individual identity i.e. by stopping to take independent individual decisions, and get into communion with Nature or God. As in any cooperative game, we have to make a coalition with the Almighty God (Nature) by merging our identity with Him which means complete surrender to the Divine Will (i.e. Bhakti Yog). Thus: the game of the life turns from non-cooperative to cooperative game.

### An Apparent Anomaly

Zero-sum game, as we have so far assumed life to be, is always a non cooperative game. How can we fit the cooperative game model to life? True, life is not really a zero-sum game. We assumed it so because the heuristics of all theoretical sciences is to begin with easy cases. Newton began his theoretical work in celestial dynamics by presuming the planets to be point masses. Having solved this problem, he next assumed them to be spheres of uniform density. In fact, life too is a non zero-sum game because the utility of the various outcomes are not same for the individual and the Nature. Nature's wealth may be aptly assumed to be infinite and so any finite gain or loss is only a trifle or negligible amount for the Nature and hence its utility for Him (Nature) is merely infinitesimal ( $\epsilon$ ) or zero (0). So, if life is regarded as a non-zero-sum game, its payoff matrix would be as below:

Table 2

		Nature (B)	
		H	T
Individual (A)	H	(+1, 0)	(-1, 0)
	T	(-1, 0)	(+1, 0)

For the Nature it is 'only a game' with nothing to gain or lose. However, for the individual it is a game (or real concern) with lots to gain and lots to lose. Nature is playing the game just for fun while the individual is playing for a definite purpose. What

this purpose is? I leave it to philosophers to decide. As a student of mathematics, I have assigned arbitrary numerical values +1 to achievement and -1 to non-achievement of this purpose.

Thus, the two-person zero-sum game of life needs to be turned into a cooperative game which admits pre-play communication to arrive at binding agreement. All religions are just the different modes of establishing links of communication and ensuring cooperation with Nature. With cooperation a new decision making entity comes into being viz. the 'pair of players' and this new entity picks out a pair of strategies which both will prefer. In the above referred game such preferred pairs are obviously (H, H) and (T, T) corresponding to the maximum total payoff  $(1 + 0) = 1$ . Both these pairs represent the strategies of having accord with Nature while the other non-preferred pairs (H, T) and (T, H) corresponding to the minimum total payoff  $(-1 + 0) = -1$  represent discord with nature.

### Conclusion

In short, the lesson is clear: where there is scope for cooperation, there is in general need for cooperation. Independent decision making is likely to end in tears. Our actions must be directed towards ensuring cooperation and not conflict with Nature. We should make sensible use of Nature and avoid its over exploration. Over exploitation of common property resources (Nature) is the  $(-1, 0)$  type solution which is disastrous to the individual and to the group as a whole. Group interest cannot be furthered by independent pursuits of individual interests. Whether others graze a common pasture less or more, it is beneficial for the individual to graze as much as possible – such situations create need for 'External Factors' i.e. intervention from higher level like police to control traffic congestion and the U.N.O. to prevent extinction of animal and fish species used for food etc.

Look not at life as struggle, in which only the fittest will survive. Life is an opportunity to work for peace, to further the common good of mankind and to lead the world to higher levels of civilization. It should lead to the Ultimate Truth and to the emancipation of soul. It is in this attitude that there lies a ray of hope for the salvation of the suffering mankind and the distressed world. May peace descend on the strife torn planet Earth and may it be the envy of the heavenly beings.

### References

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