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Title of paper: SYSTEMIC GAME THEORY: WERTERIAN APPROACH

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Abstract:

The equilibrium in a game changes once additional information has been introduced. I make the distinction between the current stand of game theory and the systemic one. The latter takes into consideration the system in which a specific game is played. The types of players are analyzed and categorized. After describing the overarching system and providing some useful tools, a new methodology of analysis is introduced. 2 by 2 matrix examples are given in support of this new methodology. Looking at the broader picture, one can understand and predict specific situations, outcomes in the real world, not in a laboratory.

KEYWORDS: Systemic game theory, higher power point, analogous vs. polar strategies.

JEL codes C70, C71, C72, C78, C79.
Game Theory and Bargaining Theory
- General
- Cooperative Games
- Noncooperative Games
- Bargaining Theory; Matching Theory
- Other

SYSTEMIC GAME THEORY: WERTERIAN APPROACH[1]

By ALEXANDRU W.POPP

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A. TERMINOLOGY

A and B are always the players; A is the row player; B is the column player; C and D are always the two strategies available to the players; DACB: player A Defects while player B Cooperates; 2D – 2 dimensions; 3D – 3 dimensions; E – the External System; e – value of the External System.

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1. INTRODUCTION

> Unlike most conventional theories in other fields of investigation, game theory is quite incapable of being empirically tested and falsified; in this respect it resembles geometry or probability theory rather than, say, psychophysics or relativity theory. The function of game theory is to provide an abstract framework for modeling situations involving interdependent choice. In some cases, including all finite, strictly competitive games, it helps us to discover how rational decision-makers *ought* to behave in order to attain certain clearly specified goals; but about how people actually *do* behave it says nothing. The ways in which human beings typically respond to problems of interdependent choice is an essentially empirical question, and it is investigated by means of experimental games in which decision-making is observed under controlled conditions.[2]

It is good to know what people *ought* to do and how they *ought* to behave. However, in the world, this is only secondary in nature. As scientists we **must** (not ought) understand why people *do* the things that they do, how they *do* behave. We must get in touch with reality.

Taken into consideration not only the players and the game, but also, the experiences that the players have and the system in which the game is played, how does the solution of the specific game change (or, how does the game change)? Under what assumptions is a game transformed? How is it transformed?

Moreover, one has to look at how the game is played. Is it: cooperation, semi-cooperation or non-cooperation? Is it egoistic? If so, then to what degree? However, the tricky part is how the utilities of these different methods of play will be incorporated in the payoffs.

2. CURRENT STAND OF GAME THEORY

Game Theory is a photo camera: it takes a snapshot at the players and the game. Because of this, it creates a two dimensions (2D) image, like a picture (Figure 1).

It has been argued, and rightfully so, that the theory is an idealistic one in which the games as well as the players, are ‘ideal’. This is the case because of the snapshot effect (2D). The latter is part of the modeling component of this theory.

In general, the axioms are self-evident truths. For game theory as a general theoretical body, the axioms are assumptions on which the rules of the game, the game itself, and the players are based.

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[2] Colman (1982), pp. 74.

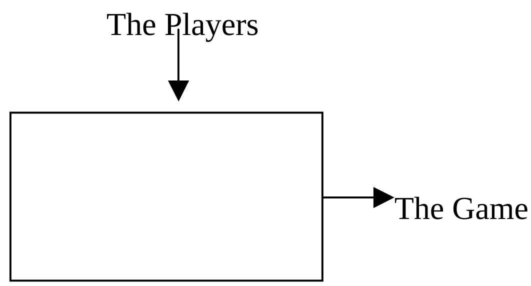

Figure 1

> In order to solve a real-world problem we abstract a model whose boundaries are exact, clear-cut. To deal with the system components and with their interactions we must impose strict methodological constraints such as boundary conditions, time horizons, definite maximization-minimization criteria, and other requirements that permit formulation, measurement, and calculations. After all is done we hope to have a model that supposedly resembles the real world and that yields a viable solution.[3]

The axioms upon which the theory rests on are very simplistic. They lack the capacity for initiative and imagination. Because of this limitation, the symptoms reflect circular models. Therefore, we have a circle

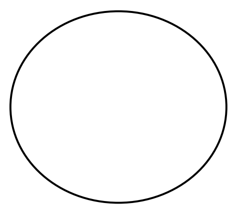

Figure 2

where both players are placed at the center (O and O') and they are expected to play the game (the circle) according to these axioms.

The way one formulates a theory is the following: from simple axioms, that are as simple as possible in order to be universally accepted, one formulates a model that tries to explain real life situations in the world, the big laboratory. The closer the model is to real life situations, the world, the better it is. This is what the scientists are supposed to do: create a simple model that explains the world.

However, as we know, game theory explains only a limited, small part of an ideal world.

[3] Gigch (1978), pp. 216.

3. FOCUSING

If one looks at the world, one realizes that it is not a 2D, but a 3D system[4]. It is the same with game theory. Noticing the external system in which the game is played and the players are part of, one gets a 3D image.

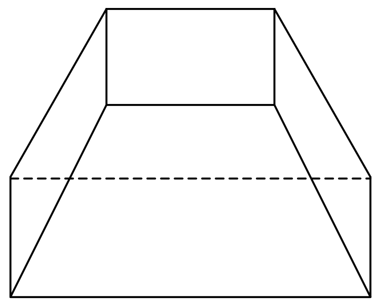

Figure 3

The picture becomes more complete. The laboratory in which the original game is played is extended to give a clearer image, a more comprehensive analysis of the situation. It becomes more complicated, having more elements to analyze, but the end result is better.

If however, one extends the games-theoretical-2D-modeling and introduces another dimension (3D, Figure 3), the modeling becomes more complicated. However, the 3D is formed out of 2Ds, a multitude of them. In real life situations, Figure 3 is not a solid, multifaceted plain object. It may be a lattice model, or it may resemble a Swiss cheese model. The important observation is not how it looks; it is that it is not a 2D model, but a 3D one.

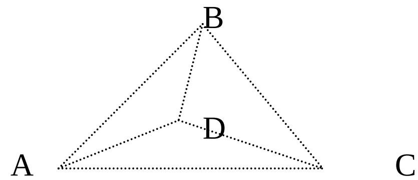

Figure 4

From Figure 4, we cannot say that point D is outwards or inwards. We can only say that the image of the figure is in 3D. That is all.

We have no information how any point (option, decision, strategy) influences the other ones. We can only say that there are 54 interactions between the parts. If we have only one point, and so no game because a game requires two players, we have only one interaction. If we have two players, we have 4 interactions. If we have three players, we have 12 possible interactions. However, this does not say anything about the types (character, attributes) of interaction that they have.

[4] I am not referring to the physical 3D: length, height and width.

These are all the possible relations between the players. Trying to analyze these possibilities, and the problem(s) between the players, we use Game Theory. In order to solve the problems, we use Decision Theory.

> Serious questions have been raised as to whether the business manager or the businessman can seriously pursue the goal of profit maximization. In the words of H. Simon, "While economic man maximizes ... administrative man, [organization man] satisfices…. Human beings … satisfice because they have not the wits to maximize."[5]
> The businessman is not the "economic man" of Microeconomic Theory who has "perfect" information and who operates in perfect markets. Rather, he is the "organization man" caught in the webs and the complexities of imperfect business environment. The assumption of "profit maximization" must be discarded for the more plausible idea of "satisfactory return." [6]

4. THE PLAYERS

> A great deal of experimentation has confirmed that decision makers do not always behave according to laws of rationality. Even in cases in which they know the rules of optimality, they refuse to implement them. In many instances, of course, a situation's complexity precludes knowledge about where the optimum lies. Optima can only be realized in the context of closed systems and models where all assumptions and marginal conditions are preestablished and known. Barring the possibility of optimizing, we proceed to suboptimize or to "satisfice."[7]

"We are, somehow, hors de la melee, aristocrats of nature who do not choose to dirty our shoes in the mud of reality."[8]

…
And makes us rather bear those ills we have
Than fly to others that we know not of?
Thus conscience does make cowards of us all,
…

Hamlet
ACT 3. SC. 1

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[5] Simon (1961), pp. xxiv – xxv.
[6] Gigch (1978), pp. 114.
[7] *Idem*, pp. 459.
[8] www.paricenter.com/library/papers/peat06.php

Even in this extended laboratory, there is a fundamental question to be asked: are we assuming rational players? If we are, and we ought to be, how rational are the players? In clarifying this question, I will assume, as I did before in my previous work, that players will play a certain game (not a 2D, but a 3D game) trying to get the biggest payoff, maximize their payoffs (again not the 2D payoff, but the 3D one).

PRINCIPLE OF RATIONALITY: Every player wishes to come out as well off as possible.[9]

Kurt Baier makes a very good observation: “granted then that ‘what shall I do?’ is a request for a value judgment, namely, ‘what is the <u>best</u> thing to do?’ we have to ask ourselves by what criteria we are supposed to judge which of the courses open to the agent is best.”[10] In the same time, what can be a reasonable and logical strategy for one person may not be for another.

Rational/rationality, “loosely, it seems to include any assumption one makes about the players maximizing something, and any about complete knowledge on the part of the player in a very complex situation, where experience indicates that a human being would be far more restricted in his perceptions.”[11] This statement concurs with the one presented by Mr. Ayer: “for us, ‘being rational’ entails being guided in a particular way by past experience.”[12] Therefore, we see that for a player to be rational, he or she needs experience. The way I introduce this element in Game Theory is through the external point(s) of Figure 4.

For others, rationality is the means (practical and efficient) to achieve the end. However, this is pragmatism. It is true that in pragmatism there is rationality, but there is more than that. Taking in consideration only what Machiavelli said that ‘the end justifies the means’, it is rational to adopt a rational or even an irrational way of thinking/method to achieve the end result (the best outcome).

Bertrand Russell stated that “life has to be lived, and there is no time to test rationally all beliefs by which our conduct is regarded. Without a certain wholesome rashness, no one could long survive.” So, basically, there is chaos.

John C. Harsanyi classified rationality as follows:

> “(A) Theoretical rationality.
> - (A1) Deductive rationality.
> - (A2) Inductive rationality.
>
> (B) Practical rationality (rational behavior).
> - (B1) Individual rational behavior.
>   - (B1a) Under certainty.
>   - (B1b) Under risk.
>   - (B1c) Under uncertainty.
> - (B2) Moral rationality.
> - (B3) Game–theoretical rationality.”[13]

[9] Stahl (1999), pp. 122.
[10] Nathanson (1985), pp. 127.
[11] Luce (1957), pp. 5.
[12] Blanshard (1962), pp. 25.
[13] Harsanyi (1982), pp. 173.

Ludwig Wittgenstein asked a very important question: “Where our investigation get its importance from, since it seems only to destroy everything interesting, that is, all that is great and important?”[14] However, Pablo Picasso stated that: “Every act of creation is first an act of destruction”.

Therefore, after seeing what rationality and reason tend to be (we do not know what exactly they are), I can make the following observation. It is wrong for Game Theory to assume rational players. The following assumption is correct:

SPECUS 1: Game Theory must assume players that play a certain game trying to get the biggest payoff (maximize their payoff).

Appendix 1 has a map of rationality that synthesises my previous research on this topic.

However, in reality, in general, people do not think like this. What they want is: the maximal benefits (payoffs) with the minimal involvement.

Moreover, players may be considered maximizers, deniers, or cooperators. For the maximizer, his own profit is primal; for the denier, doing better than his partner is primal, while its own profit is secondary; and, the cooperator is helping himself while helping his partner also.

We have two main types of players: rational and irrational. Taking in consideration Specus 1, I can state that the rational player is using an egoistic judgment: the more he gets the better it is (I call this the 1st level of rationality). For this player, any other method of judgment is irrational.

Regarding the irrational player, we can characterize him in two ways: idiot; or altruistic (I call this the 2nd level of rationality).

ALTRUISM: giving without expecting anything in return.

The altruistic player *may* have also in mind the public good.

PUBLIC GOOD: All players pay for it, but not necessary all benefit from it.

To give more descriptions about the two types of players, we can say that the egoist player is narrow-minded (subjective), while the altruistic player is broad-minded (objective).

5. THE SYSTEM

The system is the set of interrelated relative elements.

The subset is composed of the players and the game. The system is the overarching set in which all the subsets and elements interact. The system is determined by the components, state of the components, relation between the elements, and the behavior of the elements. We must notice that the system does not usually behave as initially intended to.

[14] Nathanson (1985), pp. 77.

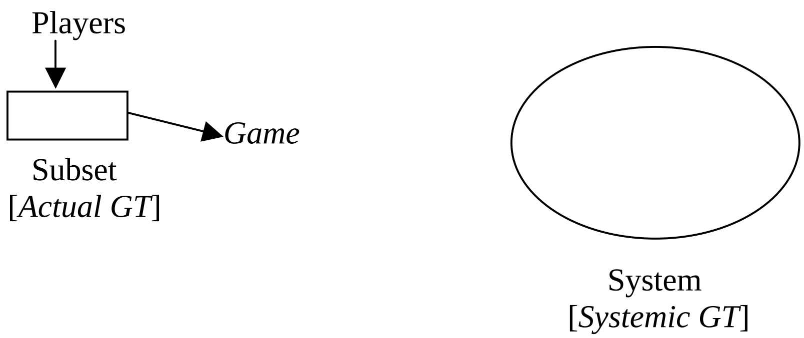

Figure 5

Characteristics of the system:

> "It is an assembly of parts or components connected together in an organized way." "The parts are affected by being in the system and are changed if they leave it." "[The] assembly of parts does something" [that is, it "exhibits dynamic behavior" as opposed to being inert]. "The particular assembly has been identified as being of special interest."[15] Furthermore, "A system may actually exist as a natural aggregation of component parts found in Nature, or it may be a man-contrived aggregation – a way of looking at a problem which results from a deliberate decision to assume that a set of elements are related and constitute such a thing called 'a system'"[16, 17]

Game Theory, as it stands now, has stagnated. It is an inert system.[18] We can see that the system is quite immobile. As scientists, we are not supposed to accept such a model. It is a dead body at the morgue and the coroner is trying to give the complete explanation of how the human body works using only one dead body. It is unacceptable.

Under this system the following problem has no solution:

> A recommendation is a prediction of behavior when the decision maker acts in a state of perfect knowledge, either knowledge that predicts with certainty, or knowledge of the true probabilities of the outcomes. As an aid to the decision maker, the scientist must do two things: He must try to improve the decision maker's state of knowledge, and he must try to find out how the decision maker would act if his ignorance were removed.[19]

Therefore, I propose as methodological system, a reconstructional one, Table 2 in the Appendix. The Poppist system combines the improvement and design in a unit and has all the latter elements except the ones in bold. Regarding the conditions of the system, I can say that the design is constantly changing. The world itself is a changing

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[15] Open University (1976), pp. 8–11.
[16] Churchman (1975), pp. 417.
[17] Gigch (1978), pp. 3.
[18] I illustrate this statement with Table 1 in Appendix 2.
[19] Gigch (1978), pp. 150.

system. That is the reason why we cannot have a fixed one. We always have to update the model with new information and new axioms.

Comparing the current stagnated game theoretical system with the Poppist system, we notice immense lacks in the former. The player's world determines the 3D system.

We must return to the scientific method:

THE SCIENTIFIC METHOD

Problem or Event Defined

↓

Observations

↓

Hypothesis Postulated

↓

Experiment Designed

↓

Measurement Made

↓

Hypothesis Accepted or Rejected[20]

These types of systems that we are dealing with are living, semi-open systems. Also, there is a high interdependence between the elements of the system that are organized in a complex way. We are interested in the consequences and we have to acknowledge that properties of organizations cannot be inferred from those of component subsystems.[21]

6. USEFUL TOOLS

6.1. *Multiplicative Multiattribute Utility Models*

The idea of utility is well known. Here, I am trying to bring this term to a new perspective. *U* being the utility, for a multiplicative model, we have the following formula

[20] Gigch (1978), pp. 182.
[21] *Idem*, pp. 49.

$$U = \prod_{n=1}^{N} f(ux_i)$$ [22]

where ux_i is the utility function regarding the individual characteristics on n substances. Ralph Keeney has stated that “the number of conditions required increases only linearly with the number of these attributes.”[23] Here we also deal with certain assumptions regarding the preferential and utility independence.

The multiplicative model has certain ‘difficulties’ obtaining the precise conditions that permitting its implementation. The specific conditions deal with

- “The step by which individual preferences are scaled if ratio scale measurements are to be achieved.

- The step by which the performance of an alternative with respect to a particular measure of effectiveness is translated into utility worth.

Many research projects gloss over these difficulties on the assumption that these conditions are automatically met.”[24] However, they are not. Is it correct to use this model? Based on the previous statement, no.

6.2. *Klee’s Algorithm*

“Klee has operationalized the use of a linear additive multiattribute utility model by developing a procedure that is relatively easy to apply and circumvents some of the methodological difficulties expressed earlier. The model applied is of the form,

$$U_j = \sum_{i=1}^{N} w_i f(ux_i) \qquad (1)$$

where

U_j = total utility for alternatives j with $j = 1, 2, \ldots, M$ alternatives
w_i = weight of factor i with $i = 1, 2, 3, \ldots, N$ attributes or factors
$f(ux_i)$ = utility worth scores for alternative j with respect to attribute i.”[25]

[22] Gigch (1978), pp. 295.
[23] *Idem.*
[24] *Idem.*
[25] *Idem*, pp. 308.

6.3. *Churchman and Ackoff Approximate Measure of Value*

Using tangential concepts of utility, Churchman and Ackoff believed that if one has to order certain preferences and give an ordinal measure, one can have the following construct:

- Having O1, O2, O3, and O4 the only four outcomes possible,
- Giving the four outcomes x, y, w, and z respectively preference numbers

then:

a. O1 is the preferred outcome above all others, having
   O1 > O2 + O3 + O4;
   x > y + w + z;

b. O2 is preferred to O3 and O4, having
   O2 > O3 + O4;
   y > w + z;

c. O3 is preferred to O4, having
   O3 > O4;
   w > z. [26], [27], [28]

6.4. *Global Convergence*

"In some coordination games, when players have limited information about opponent's behavior, almost global convergence to a single equilibrium is virtually guaranteed."[29]

"Our conclusions for games which do possess a 1/k – dominant equilibrium are quite strong: populations learn to play the predicted equilibrium from nearly all initial conditions, even when other strict equilibria are available."[30]

"Because of the randomness in the sampling procedure, the population can converge to any of these absorbing states from any interior initial condition. Nevertheless, we are able to show that if one equilibrium is 1/k – dominant, a large population is nearly certain to converge to it from nearly all initial conditions.

We call strategy s_i *asymptotically almost globally stable* if for all $\delta > 0$,

$$\lim_{N \to \infty} P\left[\lim_{t \to \infty} X_t^{N,i} = N \,\middle|\, X_0^{N,i} \geq N\delta\right] = 1.$$

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[26] Churchman (1954), pp. 172 – 180.
[27] Ackoff (1962), pp. 87.
[28] Gigch (1978), pp. 303
[29] Sandholm (2001), pp. 108.
[30] *Idem*.

In words: s_i is asymptotically almost globally stable if for any positive δ and ε, there exists an N = N (δ, ε) with the following property: if the population size exceeds N and at least proportion δ of the population initially plays s_i, then the probability that play converges to the state in which all players choose s_i exceeds 1 – ε.

We are now able to state our main result.

THEOREM 1. *If s_i is 1/k – dominant, it is asymptotically almost globally stable.*

COROLLARY 1. If k = 2, G is a 2 × 2 coordination game, and s_i is strictly risk dominant, then s_i is asymptotically almost globally stable."[31]

6.5. *Method of Dimensional Analysis*[32]

	Characteristic 1	Characteristic 2	Characteristic 3	Characteristic 4	Characteristic 5
Substance 1	F	G	H	J	K
Substance 2	X	Y	W	Q	Z

Table 3

COSTADIA 1: Having characteristics F, G, H, J and K for substance 1 and characteristics X, Y, W, Q and Z for substance 2, the ration dimension is given by

$$\lambda = (F/X)(G/Y)(H/W)(J/Q)(K/Z).$$

If λ > 0, then substance 1 is more important than substance 2. If however, there is another type of characteristic involved, importance of a specific characteristic, the formula is

COSTADIA 2: Having 1:1:3:2:1 level of importance of characteristics 1, 2, 3, 4 and 5 respectively, we have as weight ration for both substances

$$\nu = (F/X)^1(G/Y)^1(H/W)^3(J/Q)^2(K/Z)^1.$$

If ν = 1, then there is an indecision.

Table 4 shows the process of comparing alternatives characterized by complex multiattributes.

[31] Sandholm (2001), pp. 110.
[32] Gigch (1978), pp. 302–303.

6.6. *Putting in Context*

In order to solve in the <u>best way</u> the game, one has to analyze all the possibilities, basically all the possible interactions and all possible types of interaction.

Moreover, there are two basic ways to approach the game. Either the players (in a two-player game) cooperate or they do not. When a third player is introduced, there is a possibility of partial cooperation: A cooperates with B against C. There are, in this instance, 3 possible ways of semi-cooperation interaction: AB→C; AC→B; and, BC→A.

This analysis is a 2D analysis. The third dimension is introduced in the following way: how does the interaction between the players affect the External System (E)? And in the same time, how is the E influencing the interaction between the players? This is not a two turn effect: → ←, or ← →, but a one turn effect, ↔.

7. THE UNIVERSAL MATRIX

The matrix games illustrate better the situation that I am describing. There is no communication between the players. The moves are done simultaneously. Also, there is no preexisting incentive for cooperation.

The universal matrix has the following structure:

Player B

		C	**D**
Player A	**C**	R L	S M
	D	T N	V O

All L, M, N, O, R, S, T and V can take any value possible in the realm of real numbers.

There are 6 possible ways where the higher power point (HPP) is found in this matrix (denoted with Δ in Table 5). By HPP I mean the highest value in the matrix that a player can achieve. They are: CC; DD; CC and DD; DC and CD; DC; and CD. If the HPP in a game is CC, DD, CD, and DC, I consider it an idealized situation. Both players get the same amount no matter what they do, no matter how they play the game. If this is the case, then the extrapolation in the real world is that the players are GODS.

We have to notice that, as strategies 2 and 3 are equivalent (cooperation); 1 and 4 are equivalent (defection). In DISRUPTION, we have to notice that DACB and DBCA are equivalent strategies, as well as CADB and CBDA. In ASSURANCE, CACB and DBDA are equivalent strategies as well CBCA and DADB.

What are the values of **e** in each situation in order to change the game? By what increments is **e** suppose to vary in order to make a difference? In Table 5, what does a player want: to achieve Δ or not to achieve Δ?

COSTADIA 3: Every matrix game has a higher power point and corresponding higher power strategies.

COSTADIA 4: For player A, we have:

a) If $\vartheta = (L + M) / (N + O) > 1$, then C strategy is preferable to D strategy.
b) If $\vartheta = (N + O) / (L + M) > 1$, then D strategy is preferable to D strategy.[33]

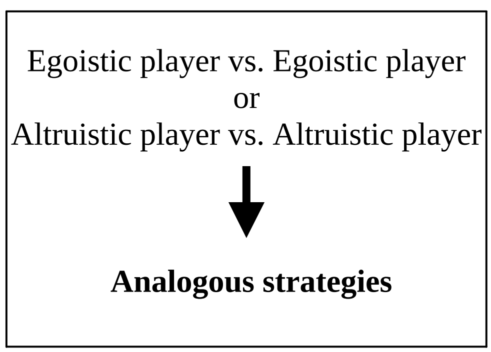
The same reasoning applies to player B as well for his corresponding strategies.

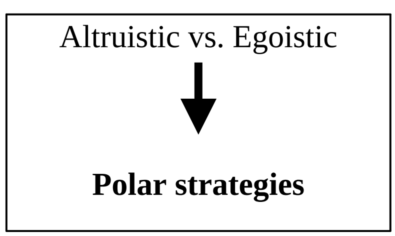
The higher the value of ϑ, the higher the preference of that strategy. If however, $\vartheta = 1$, then the player is totally indifferent between the strategies.

COSTADIA 5: If the player is indifferent regarding the strategies that it has, then that player should look at the payoffs of his opponent (2nd level of rationality).

8. NEW METHODOLOGY

I am introducing a new methodology of design. We saw that a player may behave egoistically or altruistically. Therefore, we have





[33] The mathematical calculation is a variation of λ.

By analogous strategies, I understand one of two possibilities: both players cooperate or defect. By polar strategies, I understand that one player cooperates (or defects) while the other defects (or cooperates). In Table 5, Cooperation, Defection and Assurance games require analogous strategies. However, Disruption, De-Co-y and Co-De-x require polar strategies.

9. ECONOMIC MIRROR

I will make an extrapolation between some concepts of economy, that are on the left side in Table 6, and psychology, the right side of the same table.

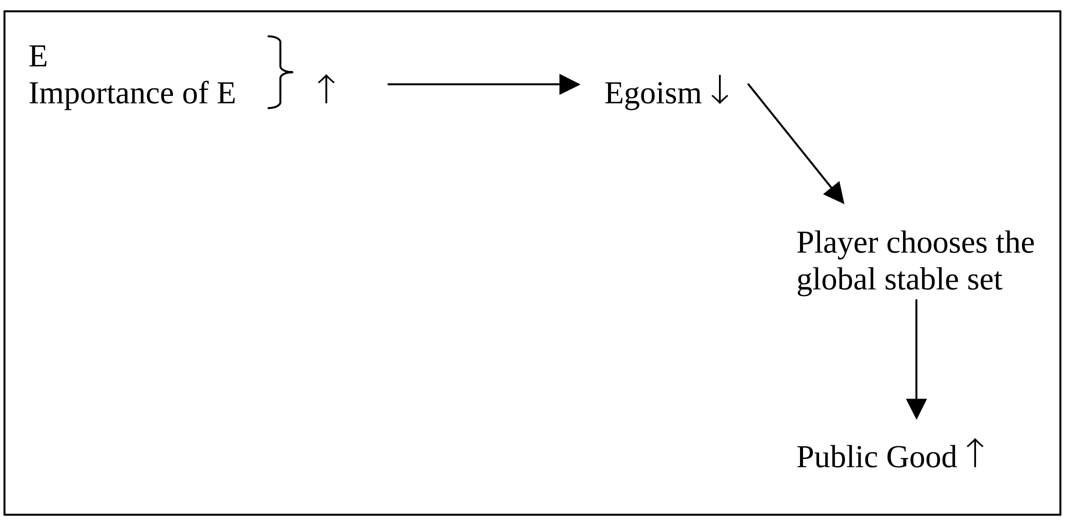
Contribution	→	Effort	[g]
Wealth	→	Willingness	[w]
Money left	→	Residue	[x]
Benefit	→	Utility	[u]

Table 6

In economics, the contribution that one has and the money left after the contribution form the wealth of that person. The psychological counterpart is: the effort and residue of a person form the willingness of that person to achieve something.

(2) $g + x = w$[34].

Diagram of Relationship and Causality



We have to notice that the willingness is dependent on the utility and the terms are direct proportional.

[34] Varian (1999), pp. 618.

We have to take into account that as E and the importance of E grow, there is an incentive for egoism to decline. Therefore, there is an incentive for the player to choose the global stable set, which at its turn, increases the public good.[35]

E, **e** and the importance of E (**e**) are combined using, at a first stage the Churchman and Ackoff approximate value measure. So, the preferences of the outcomes are determined using the dimensional analysis method. Using Klee's algorithm, we find the utilities (the benefit) of a specific outcome, and so of a specific strategy. In order to find the global stable set, we use global convergence.

From equation 2, we have

$$W_A = x_A + g_A,$$
$$W_B = x_B + g_B.$$

The total utility of the system is given by combining equations 1 and 2

$$(W_l + U_j)/2 = \theta_l,$$

where **l** represents the players and **j** the utilities of the alternatives. Because *W* and *U* are direct proportional, we find the mean between them, which would give us a more realistic value.

If θ_A is equal to θ_B, then the strategies will be analogous. In Assurance (Table 5) for example, the players will have the strategy of the HPP, in order to achieve CC. In the case where θ_A is not equal to θ_B, let us say that θ_A is bigger than θ_B, I call θ_A the public good utility and θ_B the egoist utility. We can see why we will have polar strategies in this case. B plays maximization of the play (what is good for me) while A compromises in order to achieve Δ.

In polar strategy games, we do not know what player is the row one and which one is the column one. Because of this, we have to introduce psychology to explain how the individual behaves under different circumstances, or in front of different utilities.

COSTADIA 6: If, using the universal matrix, having a Cooperation form as in Table 5, and L > R, then the egoistic player will be the row player.

COSTADIA 7: If, using the universal matrix, having a Cooperation form as in Table 5, and R > L, then the egoistic player will be the column player.

10. GAMES WITHOUT EQUILIBRIUM

DEFINITION: In a M by N matrix game, if a value is the minimum of any row and the same value is the maximum of any column, then that point is an <u>equilibrium point</u>.

[35] We have to notice that the public good is dependent of what the players want to achieve.

Therefore, for a game with the following matrix

		Player B β1	β2	Row minimum
Player A	α1	2	–3	–3
	α2	0	3	0 ← maximin
Column maximum		2	3 ↑ minimax	

we can argue that the column player will choose β1, and the row player α2 that will give them a payoff of 0. However, this is not the best outcome for both players.

Any game has a higher power outcome and therefore corresponding power strategies. In this game, 3 is the higher power outcome and α2β2 is the power strategy.

We can see that 3 is the best payoff to both players. Player A will always (supposedly) play α2 because it guaranties him a value of 3 at a cost of 0. However, if player B takes the risk of loosing 3 by choosing β2, and having Player A play as we mentioned before, the result will be a payoff of 3 to both players. We are not using mixed strategies to achieve this outcome. Only simple interpretation of psychology.

Normally, player B is the one that risks more. It is counter-intuitive to do such a thing. However, if in the first play the maximization of the payoff is achieved, then in a n-shot game, this will be the outcome.

11. OTHER EXAMPLES

11.1 *The Poor and the Rich*

	C2	D2
C1	4, 6	3, 7
D1	2, 8	1, 9

The sum of payoffs for player A is 10. For player B, it is 30. We can say that B has more to win than A. In this matrix, C1 dominates D1. D2 dominates C2. For A, 4 is the HPP, while for B, 9 is the HPP.

Difference between the values in Cells	
|C1C2|	2
|C1D2|	4
|D1C2|	6
|D1D2|	8

I will give both players' reasoning.

Player A. Taking strategy C1, A is (4 + 3)/(2 + 1) = 7/3 = 2.33 (periodical) folds better than taking strategy D1 (the value is higher than 1). Therefore, C1 is chosen.[36]

Player B [part 1]. Taking strategy C2, B is (6 + 8)/(7 + 9) = 14/16 = 0.875 folds worst than taking strategy D2 (the value is lower than 1). Normally, D2 would be the strategy chosen.

Additional Analysis. We can remark that C1/D1 value is higher than D2/C2 value. Therefore, we can say that player A 'wants' more than player B to choose C1 than player B wants to choose D2. The closer the value of the ratio dimension is to 1, the more indifferent a person is in preferring their strategy. The higher the value, the higher the preference of that strategy.

Player B [part 2]. Player B will play the game in one of the following ways:

i. Egoistically. More for B, the better it is. This strategy yields him an immediate result of 7.
ii. Altruistically. More for both, the better it is. However, we have to notice that in this matrix the C1C2 cell payoffs add to 10 as well as the C1D2 cell payoff.
iii. Altruistically, but taking an egoistic perspective in the future. B can loose 1 unit now [7 – 6 =1] and allow the other player to gain 1 unit [4 – 3 = 1], but B will ask player A concessions in the future based on this game.[37]

11.2. *The Prisoner's Dilemma: 2D-3D Analysis*

I characterize the matrixes of game theory in two ways: utility matrixes and non-utility matrixes. The following prisoner's dilemma matrix is a non-utility matrix and describes the outcomes of different strategies that both players adopt. The numbers of the matrix represent the years spent in prison by the players. The problem with this matrix is that it says nothing about how the players feel about the outcomes. It assumes that fewer years spent in prison is better. Is this assumption valid? From the matrix (2D), from real life situations (3D), it seams that is correct to assume it. However, it begs the question:

[36] Based on Costadia 4.
[37] Note that how one players one game may influence his play in the future, either with different players or with the same player. There is never a 1 shot game played by ideal players in a vacuum.

what if the assumption is not correct? The assumption is incorrect if the third dimension is introduced. Providing evidence that the latter gives more information about E, the original prisoner's dilemma matrix may change. Then, how will it change?

	C2	D2
C1	-1, -1	-12, 0
D1	0, -12	-9, -9

Matrix 1

Let us use the assumption that less years in prison has a higher utility than more years in prison. Let us consider how 'happy' the specific individual will be.

0 years → 5 happiness
1 year → -1 happiness
9 years → -7 happiness
12 years → -10 happiness

Table 7

Applying Table 7 to Matrix 1, transforming the prisoner's dilemma non-utility matrix in an utility one, we would get

	C2	D2
C1	-1, -1	-10, 5
D1	5, -10	-7, -7

.

Matrix 2

Nothing was changed. We just assigned utilities to the years spent in prison. Moreover, finding the solution of this matrix, we will not be surprised to find that D1D2 is still the equilibrium pair.

At this stage, we introduce the third dimension. This may be any 'outside' context that influences the rational of the players and so, their preferences over the strategies, and these rationales influence the exterior system.

Giving an utility to **e** and an explanation, we have

(3) e = -15 happiness
if at least 1 player goes to prison for more than 1 year.

We are not interested why e = -15. We take it as any external point to the plane (2D; Figure 1) that influences the plane (and vice versa). It is not an universal rule that any external point would yield e = -15. The latter value is an arbitrary one.

Introducing **e** to the second matrix, we will have

5 + (-15) = -10 happiness
-7 + (-15) = -22 happiness
-10 + (-15) = -10 happiness

.

Table 8

We add the 'happiness' because that is the logical mathematical way to analyze the system. If we would do any other operation between the 'happiness', it would not represent the world system, real life situations. So, introducing E to the utility prisoner's dilemma matrix, we would get the following matrix

	C2	D2
C1	-1, -1	-25, -10
D1	-10, -25	-22, -22

.

Matrix 3

Let us model the preferences of this matrix. For player A, we have

C1C2>D1C2>D1D2>C1D2.

For player B, we have

C2C1>D2C1>D2D1>C2D1.

We can notice that the 'equilibrium' of the original game shifted from DD to CC.

The main matrix was not changed. It was just transformed from non-utilitarian to utilitarian matrix, and then the external system was incorporated. We can see that the E can actually change the outcome in a matrix.

CONCLUSION

My main question is: which system, 2D or 3D, represents better the real life situations? Is it the snapshot system or a system that takes in consideration outside factors? As argued above, the 3D system provides more accurate predictions of how players behave in a game.

As Mr. Gigch[38] states that there are problems in the theoretical models, such as:

- Dealing with complexity
- Quantification
- Measurement
- Including different types of rationality
- Theory vs. Action
- "Seeking the 'ideal of reality' while implementing the "reality of the ideal"'
- Learning
- Expertise

we, as scientists are supposed to solve them. In Systemic Game Theory (SGT), some of these problems are solved. We have to take in consideration the web of systems that we do live in because we leave in a real world, not in an ideal one. If we want to predict some aspects of the future, it is better to have predictions in the real world. If the predictions are in an ideal world, how can they be useful?

"All our actions are guided by our ideas of man and society."[39] SGT takes in consideration man, the specific player, and society, the system in which man interacts. Generally, in our days, man believes in individualism: survival of the fittest. SGT incorporates these characteristics of the player and the system in the game.

Paul Weirich had a powerful statement:

> Game theory motivates revisions in principles of rational choice. And decision theory motivates revisions in accounts of solutions to games.[40]

To respond Mr. Weirich, those were my revisions

I cannot say that the game theoretical system of analysis is wrong. It is just not focused. Are we interested how players play certain games as a computer, without experience and feelings? Humans do not interact as computers.

Current Game Theory vs. Systemic Game Theory[41]

I

DICTATORSHIP: No player decides the outcome in any game.

In SGT, there is dictatorship.

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[38] Gigch (1978), pp. 565.
[39] Manis (1960), pp. 3.
[40] Weirich (1998), pp. 1.
[41] This section is dedicated to the difference between the current game theory (CGT) and systemic game theory (SGT). It is a criticism of CGT.

II

The two basic questions of CGT.

Q1: How should the players behave (in order to achieve the best outcome)?

Q2: What should the ultimate outcome of the game be (the preferred outcome)?[42]

The two basic questions of SGT.

Q1: How **will** the players behave (in order to achieve the best outcome)?

Q2: What **will** the ultimate outcome of the game be (the preferred outcome)?

III

Knowledge of chance mechanisms is CGT.

ASSUMPTION 1: "If the outcome of the game involves a chance mechanism (act of God), then each player is aware of the different possibilities and their respective probabilities."[43]

In SGT, this assumption does not exist.

IV

Knowledge of opponent's preferences in CGT.

ASSUMPTION 2: "Each player knows his opponent's preference pattern for the outcomes of the game."[44]

In SGT, this assumption does not exist.

V

The Pareto 'optimality' still holds in SGT. However, the method of achieving this 'optimum' changed. Moreover, the concept of optimum changed:

1. Optimum security level
   or
2. Optimum higher power outcome.

VI

[42] Davis (1970), pp. IX.
[43] Luce (1957), pp. 58.
[44] Luce (1957), pp. 58.

Solution in the strict sense does not change in SGT.

DEFINITION 1: "A two–person game is solvable in the strict sense if:

i. there is at least one equilibrium outcome which is Pareto optimal, and

ii. if there is more than one Pareto optimal equilibrium, all of them are equivalent and interchangeable."[45]

VII

Optimal counterstrategy of CGT.

THEOREM 2: "If one player of a game [zero or nonzero–sum] employs a fixed strategy, then the opponent has an optimal counterstrategy that is pure."[46]

In SGT, this changes. It depends on what the opponent wants: the public good or to keep A down (deny A any gain).

VIII

The value of a game in CGT.

DEFINITION 2: If Γ is a zero–sum two–person game and has an equilibrium pair, then v is the value of the game for player A

$$v = v(\Gamma) = \max_{\sigma_1 \in \Sigma_1} \inf_{\sigma_2 \in \Sigma_2} A(\sigma_1,\sigma_2) = \min_{\sigma_2 \in \Sigma_2} \sup_{\sigma_1 \in \Sigma_1} A(\sigma_1,\sigma_2).$$ [47, 48]

.

In SGT, this definition does not hold anymore because the optimal strategy is dependent on the reason that motivates a player to choose a certain strategy in a specific game.

45 Straffin (1993), pp. 70.
46 Stahl (1999), pp. 27.
47 Burger (1963), pp. 68.
48 Remark: The sup–inf/inf–sup characterize an optimal strategy.

APPENDIX 1

MAP OF RATIONALITY

- *Rationality* is linked to *Reason*.
- *Rationality* is having the capacity to *Reason*.

Reason is a human mode of judgement.
Reason is grasping needful connections.

- *Rationality* is based on skilful deliberations [reasoning].
- *Rationality* is relative → what is rational for one does not necessarily mean that is rational for another.

- *Rational behavior* does not necessarily mean *rational individual*, and vice versa.

/

- *Irrational behavior* does not necessarily mean *irrational individual*, and vice versa.
- *Rationality* is guided by experience.
- *Rationality* is to achieve the end result.

APPENDIX 2: TABLES

STAGNATED GAME THEORY

Conditions of the system	Design is set
Concerns	None
Paradigm	Analysis of systems and Component subsystems (the Analytical Method or Science Paradigm)
Thinking process	Deduction and reduction
Output	None
Method	Tries to determine new elements
Emphasis	Predictions of possible future results
Outlook	2-dimensions
Individual	Follower ought to some satisfies trends

Table 1

THE POPPIST SYSTEM

OPERATIONALIZATIONAL METHODOLOGICAL SYSTEM: SYSTEMS IMPROVEMENT AND SYSTEM DESIGN[49]		
	Systems Improvement	System Design
Conditions of the system	**Design is set**	Design is in question
Concerns	Substance	Structure & Process
	Content	Method
	Causes	Purpose & Function
Paradigm	Analysis of systems and Component subsystems (the Analytical Method or Science Paradigm)	Design of the Whole System (the Systems Approach or Systems Paradigm)
Thinking process	Deduction and reduction	Induction and synthesis
Output	Improvement of the existing system	Optimization of the Whole System
Method	Determination of causes of deviations between intended and actual operation (direct cost)	Determination of differences between actual design and optimum design (opportunity costs)
Emphasis	Explanation of past deviations	Predictions of future results
Outlook	Introspective: from system inward	**Extrospective: from system outward**
Planner’s role	Follower: satisfies trends	Leader: influences trends

Table 2

[49] Gigch (1978), pp. 11.

COMPARE COMPLEX MULTIATTRIBUTE ALTERNATIVES[50]

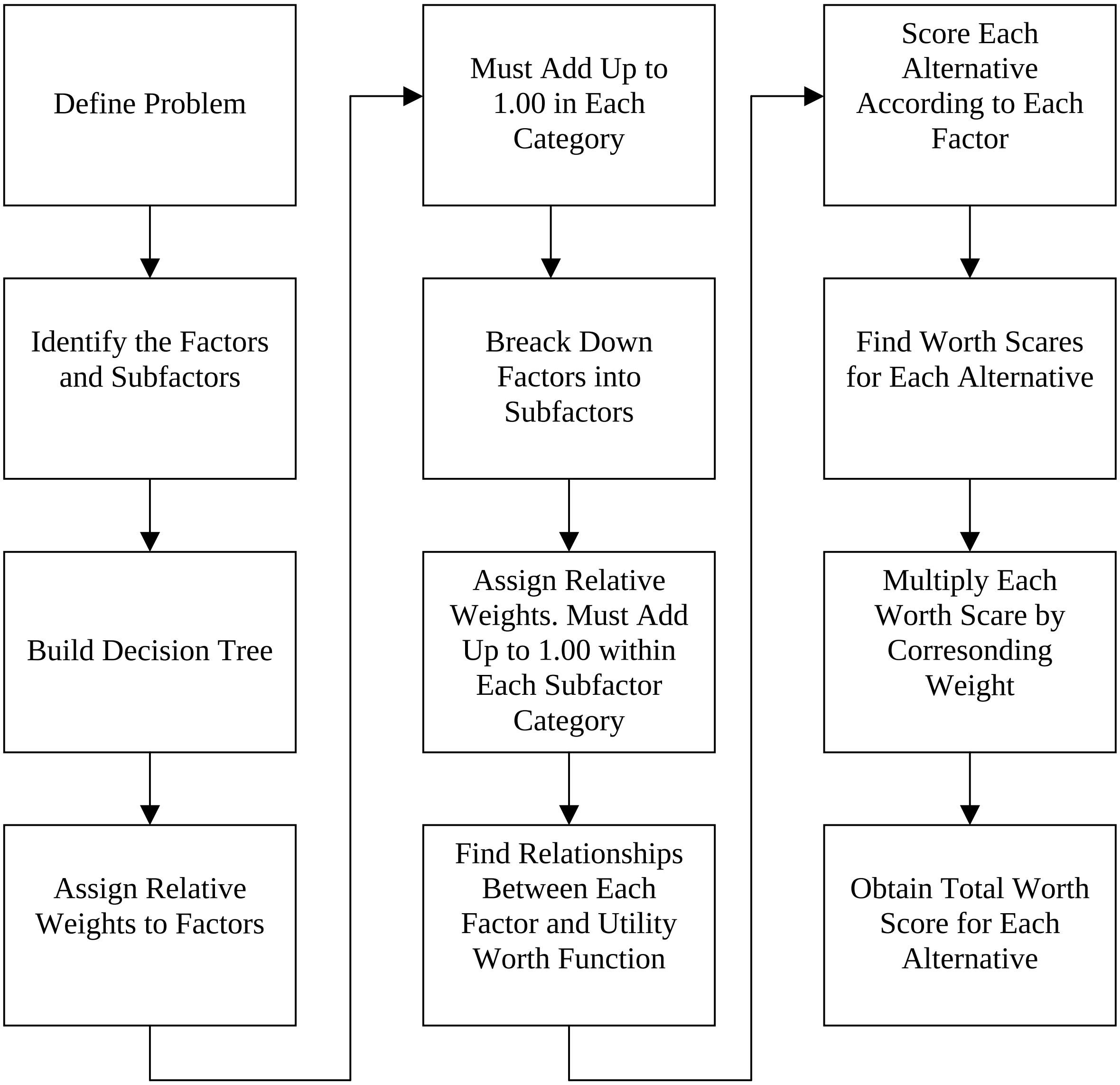

Table 4

[50] Gigch (1978), pp. 296

HIGHER POWER POINT MATRIXES

COOPERATION

	3	4
2	△	
1		

DEFECTION

	3	4
2		
1		△

ASSURANCE

	3	4
2	△	
1		△

DISRUPTION

	3	4
2		△
1	△	

DE-CO-y

	3	4
2		
1	△	

CO-DE-x

	3	4
2		△
1		

Table 5

APPENDIX 3

SYSTEMIC vs. CURRENT GAME THEORY

SYSTEMIC GAME THEORY	MATRIX[51]	CURRENT GAME THEORY

HPP – higher power point
Ego P – egoistic player
Alt P – altruism player

5	3	**3**	value = 3
			maximin strategy = [1, 0]
4	1	1	minimax strategy = [0, 1]
5	**3**		

HPP = 5
Ego P = column: [1, 0]
Alt P = row: [1, 0]

2	3	**2**	**not strictly determined**
4	1	1	
4	**3**		

HPP = 4
Ego P = column: [1, 0]
Alt P = row: [0, 1]

–2	0	–2	value = –1
			maximin strategy = [0, 1]
–1	1	**–1**	minimax strategy = [1, 0]
–1	1		

HPP = 1
Ego P = column: [0, 1]
Alt P = row: [0, 1]

---

[51] Stahl 1999, pp. 56.

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