Toward Representing Social Interaction Principles of Power Conduct in a Game Context

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Abstract: - This paper presents a new approach to the Machiavellianism (manipulation) interaction social behavior theory, based on game models. Machiavellian players are those who employ Machiavellian tactics, immorality and views in order to achieve their goals. In the game, the tactics and the immorality are represented by quasi-concave functions, and the views are represented by a quasi-convex function. Every function establishes by itself a preference relationship. Under the closure of the three ordering functions, a new order in $\mathbb{R}^3$-space is generated, representing the Machiavellianism preference relationship. The Machiavellian players interaction behavior is analyzed using the deterministic, non-iterated prisoner's dilemma game.

Key words: - Machiavellianism, game theory, Prisoner's dilemma, cooperation

1 Introduction

In recent years there has been a growing interest in interaction social model theory, which tries to understand, predict, manipulate and control the behavior of real world entities (people, organizations, government, companies, etc.). However, everyone that goes aboard this kind of interaction models must consider the behavior observations of the fifteenth-century philosopher and politician, Niccolo Machiavelli ([11], [12], [13]).

Machiavelli's primary contribution are his painfully honest observations about human nature. He highlights the natural laws that govern how effective leaders exercise power over the human resources and creates a new moral system, deeply rooted in Roman virtue (and vice). He develops his proposal against the conceptions of the Judeo-Christian self-contained moral systems. His ethical system works both as a limit of human possibilities and as the source of human virtue. Machiavelli says that human nature is aggressive, and only to some extent able to be manipulated. In this sense, Machiavelli observes that under competitive conditions the human being pursues his/her main goals with increasing levels of ruthlessness.

It is important to note that Machiavelli showed consideration for moral individuals, and recognized that there exist individuals able to sacrifice their own self-interest in order improve the interests of others. However, he did question the regular occurrence of self-sacrifice and ideal altruism behavior in the real world.

A Machiavellian individual ([4]) is one who employs aggressive, manipulative, exploiting and devious moves in order to achieve personal and organizational objectives. Theses moves are undertaken according to perceived feasibility with secondary consideration to the feelings, needs and/or rights of others.

Machiavellianism has been used to catego-

rize individuals in terms of a belief that persuasive, manipulative behavior will help to achieve personal goals. People holding this viewpoint will extol the use of guile and deceit to reach their objectives. Although Machiavelli did not recommend lying, he assumed its necessity in an imperfect world. To achieve one's objective, an individual can sacrifice truthfulness, and thereby, ethics would be sacrificed. Machiavellian individuals should not be viewed as consistently untruthful or unethical, but rather as individuals who are willing to sacrifice ethics, if necessary, to attain their objectives.

Although most of what Machiavelli had to say was intended to provide advice on how successful leaders exercise power over political organizations, his views can (and should) be applied to today's business executives and organizations, given that all organizations are subject to power politics.

Many cases of strategic interaction between agents take place in a broader context than is often appreciated. The game played between employer and employee in one firm, for instance, is typically set in the context of firm competition. This fact, in general, will have an impact on the possible emergence and stability of different equilibria. The equilibrium moral code, or set of social norms, in a given society will, in general, depend on the type of moral codes which have established themselves in neighboring societies.

This paper is structured in the following manner. After the introduction, section 2 gives the basic background in Machiavellianism. We describe the fundamental Machiavellian interaction social model assumptions in section 3. In Section 4 we introduce all the formalisms needed for the preference order of Machiavellianism. Consequently, the Machiavellian players interaction behavior is described and analyzed using the deterministic non-iterated prisoner's dilemma game in section 5. Finally, section 6 concludes the paper, presenting the current status of the work and future research directions.

2 Background in Machiavellianism

Machiavellianism has been associated with different variables, given a wide range of interpretations related to psychological components. Smith ([17]) argued that the descriptors of the psychopath and those of the Machiavellian must have common domains, because they are similar (manipulative style, poor affect, low concern about conventional moral, low ideological compromise, and others). In agreement with Cleckley ([3]) other Machiavellian tendencies coincide with some components of anomie (cynicism, low interpersonal credibility, external locus of control).

Researchers have investigated the relationship between locus of control and Machiavellianism. Solar and Bruehl ([18]) were the first in establishing a relationship between Machiavellianism and locus of control, considering both as aspects of interpersonal power. Their study reported a significant relationship between Machiavellianism and locus of control for males, but not for females. Prociuk and Breen ([15]) supported this result. Mudrack ([14]) conducted a meta-analytic review of 20 studies determining the relationship between Machiavellianism and external locus of control. Gable, Hollon and Dangello ([8]) sustain this result. They related locus of control, Machiavellianism and managerial achievement; their results did not show significant correlations between locus of control and achievement, but found a positive correlation between Machiavellianism and external control.

With respect to influence tactics, Falbo ([7]) showed that persons with high Machiavellianism are associated with the use of rational indirect tactics (i.e., lies), while those with low Machiavellianism are associated with the rational use of direct tactics (i.e. rewards). Grams and Rogers' ([9]) research confirms this result and also shows that persons with high Machiavellianism are more flexible when it comes to breaking some ethical rules. Vecchio and Sussman ([19]) suggested that Machiavellianism and tactics selection are related to gender and organizational hierarchy; the use of influence tactics is common in males and females with high-level positions.

In accordance with different studies of social psychology, manipulation is placed among the forms of social influence as part of the social interaction behavior. Raven ([16]) argued that power can be psychologically studied as a product of behavior, including personal attributes, with the possibility to affect others through interaction, and the environment structure. Dawkins ([5]) proposed that, in terms of selfishness, altruism, cooperation, manipulation, lie and truth, genetically there exists a self-

ishness and manipulation gene. Dawkins and Krebs ([6]) classified manipulation as a natural-selection state benefiting individuals able to manipulate others' behavior. Vleeming ([20]) denotes a personality dimension in which people can be classified in terms of being more or less manipulated in different interpersonal situations. Wilson, Near and Millar ([21]) define Machiavellianism as a social strategy behavior involving the manipulation of others to obtain personal benefits, frequently against others' interests. They clarify that anybody is able to manipulate others to different degrees, and they also explain that selfishness and manipulation are behaviors widely studied in evolutionary biology. Hellriegel, Slocum Jr. and Woodman ([10]) define Machiavellianism as a personal style of behavior in front of others, characterized by: the use of astuteness, tricks and opportunism in interpersonal relationships; cynicism towards other persons' nature; lack of concern with respect to conventional morals. Christie and Geis ([2]) propose three factors to evaluate high or low Machiavellianism: tactics, morality and views. Tactics are concerned with planned actions (or recommendations) to confront specific situations with the purpose of obtaining planned benefits at the expense of others. Morality is related to behavior that can be associated with some degree of "badness" with respect social conventions. Views involve the idea that the world consists of manipulators and manipulated. In this sense we introduce the following definition.

Definition 1 *Machiavellianism is a social interaction model supposing that the world can be manipulated by applying (Machiavelli's) strategies and tactics with the purpose of achieving personal gains according (or not) to a conventional moral.*

Immorality is a un-arrangement of customs. One of the best-known concepts is the immorality described by Nietzsche. Therefore, the factor of morality proposed by Christie and Geis ([2]) is not appropriate, because in the evaluation of the factor, immorality is considered the opposite to a "conventional moral".

The notion of a tactic to guide planning is an important concept in different application domains such as military, business, negotiation, etc., however it is confuse in the Machiavellianism definition of Christie and Geis ([2]). Their statement concerns formulating tactics, instead of developing plans to achieve goals in accordance with a set of tactics.

We conceptualize plans, tactics and goals as different but related concepts. Plans are a sequence of roles established to achieve the entity's goals. Goals are objectives that the entity attempts to achieve. Tactics are general principles that guide the generation and selection of goals. For instance, in the Gulf War the U.S.-led coalition had the goal of "liberating Kuwait" and for doing so it could either adopt a "defensive" or "offensive" strategy. The choice of a particular strategy will affect the plans. The coalition chose an offensive strategy and began a plan using a "massive air war to destroy Iraq's forces and military and civil infrastructure". The coalition could have for instance chosen a more defensive strategy and apply a different plan to liberate Kuwait "fighting on foot using tanks and infantry troops".

For the purposes of this paper, we will consider the terms views, tactics and immorality defined as follows:

Views: The belief that the world is able to be manipulated.

Tactics: The use of a manipulation plan guided by strategies to achieve specific a power situations (goals). Plans, strategies and goals are analyzed in Machiavelli's The Prince ([11]), The Discourses ([12]), The Art of War ([13]), as they were described above considering the psychological behavior patterns.

Immorality: The disposition to not become attached to a conventional moral.

These three factors are statistically evaluated to a certain degree through a set of variables considered in the tests Mach IV and Mach V ([2]). Other tests could be used to measure the degree of Machiavellianism, but it is important to verify the way they are employed for internal consistency and stability.

3 Machiavellian Fundamental Model Assumptions

The Machiavellian interaction social behavior model can be described in terms of game theory as follows: in the model, the real world is composed of players that represent complex systems. A Machiavellian player is one who employs Machiavellian tactics, immorality and views in order to achieve his/her goals. Machiavellian players interact with other entities in

the environment and their behavior is rationally bounded. This relationship is conditioned by the fact that Machiavellian players must compete for power with other players. In order to acquire power (manipulate), survive or sustain a particular position, Machiavellian players make use of different manipulation actions and strategies, which include looking for controlling the changes taking place in the environment, often initiated by other competing players. Machiavellian players will make use of any possible means in order to reach their main goals. They will act out of selfishness avoiding public morality, but only when it is necessary. Sometimes, Machiavellian players collaborate with one another in pursuit of common goals and exercise collective power over other players in their environment, without losing their personal goals. Machiavellian players always pursue power (manipulation) situations, but their success will depend on their Machiavellian intelligence.

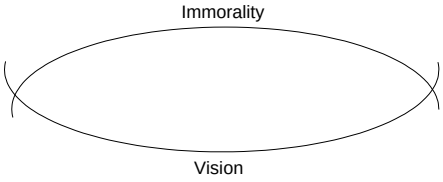

Figure 1

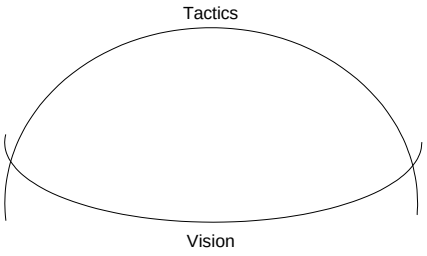

Figure 2

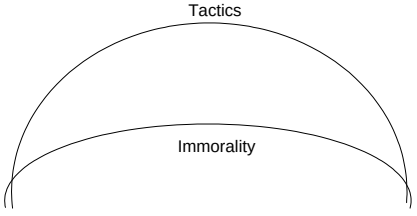

Figure 3

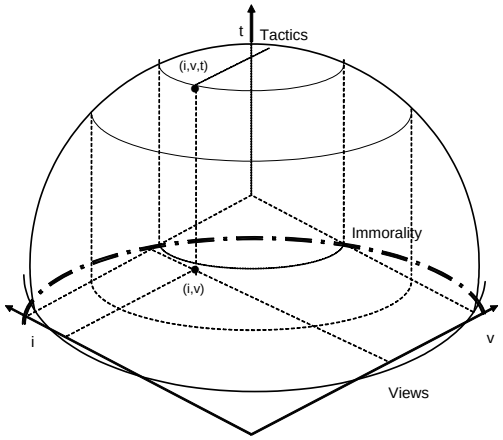

Figure 4. Machiavellian Space

In the Machiavellian social interaction model, we do not expect highly Machiavellian individuals to be non-cooperative in all situations, but we do expect them to be tempted to defect as a usual choice, to be more experienced at the practice of defection, and to make use of it in a more extended scope of social interaction circumstances than individuals with low Machiavellianism. In this sense, we present in Figure 4 an $\mathbb{R}^3$ representation of Machiavellianism constructed by the closure of three utility functions: i) the views utility function represents the knowledge of manipulation characteristics that has an individual (its minimum corresponds to the situation that the world is not able to be manipulated); ii) the immoral utility function represents the social rules that an individual is able to not respect (its maximum corresponds to the situation of an individual who has no moral); iii) the tactics utility function represents the moves ahead that an individual is able to choose. Its minimum indicates that no tactic can be selected. In Figure 1, 2 and 3 are presented projections of the $\mathbb{R}^3$ Machiavellian space.

In accordance with Machiavellianism expected behavior, we propose the following fundamental assumptions:

Assumption 1. Probability. The variables views, immorality and tactics have a continuos probability distribution function.

Assumption 2. Euclidian Space. Every dimension of the Machiavellianism represents a dimension in the Euclidian space, i.e. views, immorality and tactics can be represented as an $\mathbb{R}^3$ space.

Assumption 3. Convexity. The minimum

of views represents the lack of knowledge of manipulation characteristics. The maximum of immorality is no morality at all, i.e. an individual who follows no social rules. The minimum of tactics is no possible move ahead.

Assumption 4. Rationality. The maximum utility values obtained from the closure of the utility functions views, immorality and tactics represent the highest Machiavellianism, whereas the minimum values represent the lower Machiavellianism.

4 Machiavellian Preference Order

We begin with some notions and a description of the tools to be used for the subsequent analysis. Assume that the number of participating players in the Machiavellian game world is fixed. Assume also that the Machiavellian behavior, which these players can take is finite and fixed. The Machiavellian interaction social behavior is a stochastic process ([2]). The set of variables related with Machiavellian interaction social behavior are a set of random variables that have a distribution function Γ, which are defined on ([1]) a probability space $(F, \Im, P)$, having all its random variables indexed, independent and identically distributed with a finite mean and variance.

Machiavellianism considers the natural laws that govern how effective leaders exercise power over other individuals. Players determine their Machiavellian behavior options by the joint probability distribution of the Machiavellian views, immorality and tactics. Let n denote the total number of available Machiavellian behavior options, and let s_i denote the relative frequency of players that take Machiavellian behavior option i for exercising power, such that $\sum_{i=0}^{n} s_i = 1,\ s_i \geq 0\ \forall i \in \{1, ..., n\}$. Let $s = (s_1, ..., s_n)$ represent the distribution vector of Machiavellian (discrete) behavior frequencies. Then, the set of all probability distributions of the Machiavellian interaction social behavior is defined by $S = \left\{ s \in \mathbb{R}_+^n : \sum_{i=1}^{n} s_i = 1 \right\}$ the n dimensional simplex (see assumption 1). State s can only take values in S. In this sense, every dimension of the Machiavellianism represents a dimension in the Euclidian space, i.e. views, immorality and tactics represents an $\mathbb{R}^3$ space (see assumption 2).

The objectives of a Machiavellian decision maker are summarized in a preference relationship. It is assumed that $\leq$ establishes a poset on S, i.e., given $s, t, r \in S$ we expect the preference relation $\leq$ to fulfill, the following axioms hold: reflexivity ($s \leq s$), antisymmetry ($s \leq t$ and $t \leq s$ implies that $s = t$), transitivity ($s \leq t$ and $t \leq r$ implies that $s \leq r$). Although the preference relation is the basic primitive of any decision problem (and generally, observable) it is much easier to work with a consistent utility function $u : S \to \mathbb{R}$ because we only have to use n real numbers $u = \{u_1, ..., u_n\}$. A utility function $u : S \to \mathbb{R}$ is consistent with the preference relationship of a decision problem $(S, \leq_{u_i})$ if for all $s, t \in S : s \leq_{u_i} t$ if and only if $u(s) \leq u(t)$. The preference relation $\leq_{u_i}$ induce a von Neumann-Morgenstern utility function. Given any set $Q \subseteq S$ of actions that are viable in some specific case, a rational Machiavellian decision maker chooses an action $s^{'} \in Q$ that is viable and optimal in the sense that $u(s) \leq u(s^{'})$ for all $s \in Q$ solving the problem $max_{s \in S} u(s)$. A Machiavellian rational decision maker who deals with a decision problem selects a strategy $s \in Q$ which maximizes his utility. An assumption upon which the efficiency of this model of decision making depends is that an individual makes use of the same preference relation $\leq_{u_i}$ when choosing from different sets Q.

Each axis of the Machiavellianism space has a distinct utility representation and the preference relation depicting the choice behavior is representable as a real-valued function defined on the components utilities. From the previous assumptions we will define the heuristics measure of the utility functions related with the terms views, immorality and tactics as follows:

- S is the knowledge of manipulation characteristics and $\forall s \in S : u_V(s)$ is the knowledge of manipulation characteristics of the environment that an individual has respect to the total knowledge of manipulation characteristics of the environment. The minimum of the utility function represents that the world is "not" able to be manipulated. The function u_V is a quasiconvex function and establish a preference relationship denoted by $\leq_V$.

- S is the set of social rules and $\forall s \in S : u_I(s)$ is the social rules that an individual is able to disregard from a total set of

social rules. The minimum of the utility function represents highest level of morality of an individual. The function u_I is a quasi-concave function and establishes a preference relationship denoted by $\leq_I$.

- S is the set of possible moves and $\forall s \in S$: $u_T(s)$ is the number of moves ahead that an individual is able to select from a total set of moves. The maximum of the utility function represents the best manipulation choice of tactic able to be taken by an individual. The function u_T is a quasi-concave function and establish a preference relationship denoted by $\leq_T$.

Let the utility function u_i be linearly ordered, such that

$$\forall s, t \in S : (s <_{u_i} t) \vee (s \equiv_{u_i} t) \vee (t <_{u_i} s) \quad (1)$$

and let $\equiv_{u_i}$be the equivalence relation on S induced by u_i

$$\forall s, t \in S : s \equiv_{u_i} t \Longleftrightarrow u_i(s) = u_i(t) \quad (2)$$

then the collection of equivalence classes $\{S/\equiv_{u_i}\} = \bigcup_{i \in N} S/\equiv_{u_i} = \{\pi_i(s) | s \in S\}$ is a poset. Thus, $\{S/\equiv_{u_i}\}$ is linearly ordered and, consequently, it is a lattice. The structure $\{S/\equiv_{u_i}\}$ is indeed trivial: all elements in S giving the same value under u_i are identified in this quotient set.

On the other hand, let us consider the relation $\leq_{u_i}$as follows:

$$\forall s, t \in S : s \leq_{u_i} t \Longleftrightarrow u_i(s) \leq u_i(t) \quad (3)$$

For any $s \in S$ let successors of s:

$t \in suc(s)$ iff $s \neq t, s \leq_{u_i} t$ and
$\forall q : (s \leq_{u_i} q \leq_{u_i} t) \Longrightarrow (q = s) \vee (q = t)$,

predecessors of s:

$t \in pre(s)$ iff $t \neq s, t \leq_{u_i} s$ and
$\forall q : (t \leq_{u_i} q \leq_{u_i} s) \Longrightarrow (q = t) \vee (q = s)$,

Let $G_{\{u_i\}}$be the graph whose set of nodes is S and for each pair $(s,t) \in S : (s,t)$ is an edge iff $t \in suc(s)$, or equivalently, $s \in pre(t)$. Let us say that u_i is consistent if $G_{\{u_i\}}$ has no cycles. From now on, we will consider only consistent functions. Thus, u_i is inducing a hierarchical structure on S.

The minimal elements are those with no predecessors, i.e. nodes with null inner degree in $G_{\{u_i\}}$. The maximal elements are those with no successors, i.e. node with null outer degree in $G_{\{u_i\}}$

Let us define the upper distance d^+ as follows:

$$d^+(s,t) = 1 \Longleftrightarrow t \in suc(s)$$
$$d^+(s,t) = 1 + r \Longleftrightarrow \exists q : d^+(s,q) = r \ \& \ d^+(q,t) = 1$$

Similarly, the lower distance d^-

$$d^-(s,t) = 1 \Longleftrightarrow t \in pre(s)$$
$$d^-(s,t) = 1 + r \Longleftrightarrow \exists q : d^-(s,q) = r \ \& \ d^-(q,t) = 1$$

Thus $d^+(s,t) = d^-(t,s)$. The upper height of a node s is $h^+(s) = max\{d^+(s,t) | t \text{ is minimal}\}$. The lower height of a node s is $h^-(s) = max\{d^-(s,t) | t \text{ is maximal}\}$.

Let $S \neq \emptyset$ and let $u, w : S \to \mathbb{R}$ be two real functions.

Let us say that u is an *eq-refinement* of w if

$$\forall s_1, s_2 \in S : (u(s_1) = u(s_2)) \Longrightarrow (w(s_1) = w(s_2)) \quad (4)$$

In this case, $(S/\equiv_u)$ is an homomorphic image of $(S/\equiv_w)$ (both are linearly ordered sets).

Let us say that u is an *ineq-refinement* of w if

$$\forall s_1, s_2 \in S : (u(s_1) \leq u(s_2)) \Longrightarrow (w(s_1) \leq w(s_2)) \quad (5)$$

In this case, the ordering $\leq_u$ is included, as a set in S, in the ordering $\leq_w$. Hence, it follows that G_w is an homomorphic image of G_u, i.e. G_w can be realized as a subgraph of G_u.

We may introduce a stronger notion to compare functions. For instance, let $Sgn : \mathbb{R} \to \mathbb{R}$ be such that

$$\forall x \in \mathbb{R} : x > 0 \Longrightarrow$$
$$Sgn(x) \begin{cases} 1 & x = 0 \\ 0 & x < 0 \\ -1 & otherwise \end{cases}$$

Let us say that u is an *tonal-refinement* of w if

$$\begin{aligned} \forall s_1, s_2 \quad &\in \quad S : Sgn(u(s_1) - u(s_2)) = \\ &\quad\; Sgn(w(s_1) - w(s_2)) \end{aligned} \tag{6}$$

In this case, G_w is isomorphic to G_u.

The von Neumann and Morgenstern utility assessments called a preference probability determined by a preference relation $\leq_{u_i}$that establish a poset.

Given three utility functions $u_V, u_I, u_T : S \to \mathbb{R}$, inducing respectively the three preference orders of the Machiavellianism vision ($\leq_V$), immorality ($\leq_I$) and tactics ($\leq_T$), it is interesting to decide whether there is a hierarchy that represent the preference order of the Machiavellianism ($\leq_M$) in S induced by the closure of $u_M = u_V * u_I * u_T$ ($\leq_M = \leq_V * \leq_I * \leq_T$). We may proceed with the following approaches:

Ordering Product: Let $\mathbb{R}^3$ be ordered with the product of the usual ordering in $\mathbb{R}$:

$$\begin{aligned} (x_1, y_1, z_1) \quad &\leq \quad (x_2, y_2, z_2) \Leftrightarrow (x_1 < x_2) \vee \\ (x_1 \quad &= \quad x_2 \wedge y_1 < y_2) \vee \\ (x_1 \quad &= \quad x_2 \wedge y_1 = y_2 \wedge z_1 \leq z_2) \end{aligned}$$

Then

$$\begin{aligned} \forall s_1, s_2 \in S : s_1 \leq_{(u_V, u_I, u_T)} s_2 \Leftrightarrow \\ (u_V(s_1), u_I(s_1), u_T(s_1)) \leq \\ (u_V(s_2), u_I(s_2), u_T(s_2)) \end{aligned}$$

The considering this ordering we get a graph $G_{(u_1, u_2, u_3)}$ on S.

Graphs Products: Let G_{u_V}, G_{u_I}, and G_{u_T} the graph on S obtained by u_V, u_I, and u_T respectively. Let $G_{u_V * u_I * u_T}$ be the union of G_{u_V}, G_{u_I}, and G_{u_T} such that:

$$\begin{aligned} (s_1, s_2) \quad &\in \quad S \text{ is an edge in } G_{u_I * u_V * u_T} \quad \Leftrightarrow \\ ((s_1, s_2) \quad &\in \quad S \text{ is an edge in } G_{u_V} \;) \vee \\ (s_1, s_2) \quad &\in \quad S \text{ is an edge in } G_{u_I} \;) \vee \\ (s_1, s_2) \quad &\in \quad S \text{ is an edge in } G_{u_T} \;)) \end{aligned}$$

It is clear that $G_{u_V * u_I * u_T}$ has no cycles provided that of G_{u_V}, G_{u_I}, and G_{u_T} has no cycles. However, this condition is not sufficient in order to get $G_{u_V * u_I * u_T}$ free of cycles.

Products of Petri Nets: Suppose that three given Petri nets.

The process obtained by the synchronized running of both processes can be specified by the product net $PN = PN_1 \times PN_2 \times PN_3 = (P, Q)$ such that

- $P = P_1 \times P_2 \times P_3$
- $Q = Q_1 \times Q_2 \times Q_3$
- the procedural semantics of the net is defined component wise, i. e. a transition (q_1, q_2, q_3) can be fired at places $((p_{1j}, p_{2j}, p_{3j}))_j$ if and only if each q_i can be fired in PN_i at places $(p_{ij})_j$, with postconditios determined likely

Nevertheless some special care should be undertaken regarding both starting and ending conditions on the product net. Thus whenever a finite set of processes is specified by Petri nets the synchronized running of all processes can be specified by another Petri net.

Accordingly with all what was discussed we formally can establish the following result.

Proposition 1 *Let u_M the Machiavellian utility function and let $\leq_M$ the Machiavellian preference relationship. Then, u_M is consistent with $\leq_M$ if*

$$\forall s, t \in S : s \leq_M t \iff u_M(s) \leq u_M(t) \tag{7}$$

Proof 4.1 *The proof is straightforward from the above definitions*

5 Machiavellian Behavior and Game Model

"Therefore it is unnecessary for a prince to have all the good qualities I have enumerated, but it is very necessary to appear to have them. And I shall dare to say this also, that to have them and always to observe them is injurious, and that to appear to have them is useful; to appear merciful, faithful, humane, religious, upright, and to be so, but with a mind so framed that should you require not to be so, you may be able and know how to change to the opposite."

According with this paragraph, Machiavelli describes the kind of behavior related with lying and raw political power. It makes no difference whether an individual's goals, strategies, purposes, or interests are morally right or wrong. He describes what effective leaders must do in order to most efficiently manipulate the environment, achieve their goals and sustain their positions. He focused on how effectively leaders

must interact with their "followers" within their organizations and how they deal with external competitors, in order to insure the survival of themselves and their organizations. He also observed that entities' behavior is naturally selfish, looking for fulfilling first their own interests, goals, or purposes. Consequently, there arises the following question: When does Machiavellianism succeed in competition with other forms of social behavior that are less manipulative?

The "prisoner's dilemma" is used as a first approach in game theory to conceptualize the conflict between mutual support and selfish exploitation among interacting Machiavellian players. The game can be illustrated by an example where two men are arrested for a crime. The police tell each suspect separately that if he testifies against the other, he will be rewarded for testifying. Each prisoner has two possible strategies (table 1): to testify or to defect (not testify). If both players defect, there is a mutual punishment with a score of P (the punishment corresponding to mutual defection, in this particular case equal to zero, given that there is supposedly no proof to convict either of the two). If both cooperate, there is a mutual reduction of punishment, resulting in a payoff value of R. However, if one testifies and the other defects, the defector receives a considerable punishment reduction (payoff of T, the temptation for defection), and the other player receives the regular punishment (payoff of S, the "sucker" payoff for attempting to cooperate against defection). This game has usually two equilibrium points: one cooperative (both prisoners help each other by not testifying) and the other one non-cooperative (both prisoners testify to the police).

Player1 \ **Player2**	**Not Coop.**	**Coop.**
Not Cooperate	R, **R**	S, **T**
Cooperate	T, **S**	P, **P**

Table 1. Prisoner's dilemma utility function

Qualitatively, we distinguish four possibilities in the game arrangement, concerning the existence of equilibrium points: besides the one mentioned above, keeping either one of the two equilibrium points, or else none. Our purpose is to analyze the probable response of individuals to the different game situations as a function of their degree of Machiavellianism. These cases correspond formally to the following description:
case 1:

Consider conditions $T > R$ and $S > P$, with $S + T = 2R$, where $R > S$ results from $S + T = 2R$, an equality often adopted out of a sense of social justice, but which has no consequence in the qualitative mathematical sense, as far as the existence of equilibria is concerned. Out of the four cases, as its name tells, this is the case where a genuine dilemma exists, due to the existence of both kinds of equilibria. Therefore, we expect the decision of the Machiavellian player to cooperate or not cooperate to be a function of both the actual proportions between payoffs, and the degree of immorality of the player.
case 2:

$T > R$ and $P > S$ (non-cooperative equilibrium only): not cooperating represents the best strategy, so the Machiavellian player is expected to apply it consistently.
case 3:

$R > T$ and $S > P$ (cooperative equilibrium only): the rational decision here would be to always cooperate. However, depending on tactics rating, the Machiavellian player may choose to inflict a higher loss on the opponent, an option that may exist for $T <> S$.
case 4:

$R > T$ and $P > S$ has no equilibria at all. This case corresponds to two people playing "chicken" (daring each other until one – or both – lose everything). Depending on views rating, the Machiavellian player may choose to face the dare.

6 Conclusions and future work

A formal framework for game theory of the Machiavellian interaction social model has been presented. A new definition of Machiavellianism that extends the definition of Christie & Geis ([2]) was introduced. We introduce three different preference orders to represent the Machiavellian concepts of tactics, immorality and views.

The Machiavellian players interaction has been described by a deterministic "one-shot" prisoner's-dilemma-type game, to link the specific regions of the multidimensional space that conform the social interaction model of Machiavellianism. The psychology literature proposes for the vision that Machiavellian players applies non-cooperative strategies, but, the prisoner's

dilemma can not reflect the whole complexity of human social strategies.

As future work we want to focus on two issues: introducing quantitative expressions for the three descriptors of Machiavellianism and statistically evaluate their influence on Machiavellian game behavior. Then, we would like to develop different strategies for repeated games, considering past experiences with opponents, based on the aforementioned statistics.

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