# Towards The Stability Analysis of Principles of Power Conduct

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**Abstract.** One of the major problems in the Machiavellian (manipulation) interaction social model is establishing its key property of stability, which is important in behavior evaluation and control. This paper presents a formal framework for Machiavellian dynamic stability analysis and model validation. We assume that Machiavellianism is a stochastic process, and as a consequence, it can be described by a model whose result set is in the basic set of elements of the Machiavellian Stochastic Process. An autoregressive model AR(1) is proposed to represent the dynamics of the Machiavellian interaction social model. An estimation matrix, an identification model and an error estimation model are employed to implement the stability properties of the Machiavellian interaction social model. System stability of a Machiavellian individual is being considered. An illustrative example with a simulation of the model is given.

Key words: interaction social model, Machiavellianism, stability.

## 1 Introduction

In this work we focus on the interaction principles of conduct laid down by Machiavelli. The importance of Machiavelli in the development of organizational theory consists in that he was among the first to identify the natural laws that govern how effective leaders of hierarchical organizations exercise power over the human resources within such an organizational system.

Machiavellianism has been used to categorize 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


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their objectives ([14], [15], [16]). 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 therefore, 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.

Christie and Geis [3] were the first to study manipulation as a fundamental parameter in human behavior variation, calling it "Machiavellianism". They showed that Machiavellians tend to have a "utilitarian rather than a moral view of their interactions with others". There is an inconsistency between earlier opinions that Machiavellians lack a sense of morality, and current research showing how Machiavellians may indeed behave in a relatively moral fashion [13].

The paper is structured in the following manner. After this introduction, section 2 gives the basic background in Machiavellianism. Section 3 extends the definition of Machiavellianism. We describe the Machiavellian interaction social model in section 4. In Section 5 we introduce all the formalisms needed for the stability analysis of the Machiavellian system. Consequently, we present the estimation error model in section 6. In section 7 we describe the Estimator and Identifier Filters. Section 8 presents an application example with the corresponding simulation. Finally, section 9 concludes the paper which presents 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 [20] 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 [4] 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 [21] 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 [18] supported this result. Mudrack [17] conducted a meta-analytic review of 20 studies determining the relationship between Machiavellianism and external locus of control. Gable, Hollon and Dangello [9] 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 [8] 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' [11] 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 [22] suggested that Machiavellianism and the tactics selection are related to sex and organizational hierarchy; the use of influence tactics is common in males and females with high-level positions.

## 3 Definition of Machiavellianism

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 [19] 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 [6] proposed that, in terms of selfishness, altruism, cooperation, manipulation, lie and truth, genetically there exists a selfishness and manipulation gene. Dawkins and Krebs [7] classified manipulation as a natural-selection state benefiting individuals able to manipulate others' behavior. Vleeming [23] 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 [24] 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 [12] 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 [3] 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 [3] is not appropriate, because in the evaluation of the factor, immorality is considered the opposite to a "conventional moral".

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 specifica power situations (goals). Plans, strategies and goals are analyzed in Machiavelli's ThePrince [14], The Discourses [15], The Art of War [16] and the psychological behavior patterns (section2).

**Immorality:** The disposition to not be come 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 (Christie & Geis, 1970). Such results, in agreement with Christie and Geis (1970), are described by a well-known distribution function. Other tests could be used to measure the amount of Machiavellianism, but it is important to verify their coefficients for internal consistency and stability.

## 4 Machiavellian social interaction model

In agreement with Gnedenko [10] and Caines [2], considering its properties as a part of an innovation process, Machiavellianism could be described as a stochastic process. The problem is to measure the Machiavellian variables and to analyze their properties [**?**].

In the Machiavellian stochastic process we find a set of personality variables (random variables) with correlation to the Machiavellianism, as defined in Christie and Geis [3]; Falbo [8]; Gable, Hollon, & Dangello [9]; Grams & Rogers [11]; Mudrack [17]; Prociuk & Breen [18]; Solar & Bruehl [21]; Vecchio & Sussmann [22]; Vleeming [23]; and others. Some random variables are: influence tactics, leadership, locus of control, cynicism, organizational commitment, impulsivity, and others.

A Machiavellian stochastic process could be described in recurrent times using a filter theory as a descriptor of real processes, which is considered to generate a good enough answer. This model is also described by a probability distribution function of the process, defined by its two probability distribution moments.

In the present work, we would like to verify whether an autoregressive model captures the essential concept of a Machiavellian system and, given the environment dynamics, allows to satisfy a stationary distribution function.

The simplest form of this kind of systems is an AR(1) model with additive perturbations. In symbolic form, the Machiavellian social interaction model could be described as:

$$y_k = Ay_{k-1} + B_k\Psi_k \tag{1}$$

where $A$ is the gain matrix of the internal properties. The set of its eigenvalues are inside of the unit circle, which guarantee the distributional invariance conditions and hereby stability in terms of mean and variance of the process. represents the influence of the immediate past state of the individual. $B$ is the matrix of the random condition of the individual's environment, and is an interaction vector with the environment.

The system described in (1) is obtained from:

$$x_k = Sx_{k-1} + b\omega_k \ , \tag{2}$$

$$y_k = x_k + c\upsilon_k \ , \tag{3}$$

where: $B_k = \left[-Sc \vdots cb \vdots c\right]$, $\Psi_k = \left[\upsilon_{k-1} \vdots \omega_k \vdots \upsilon_k\right]^T$ and $A = S$ which describes the internal dynamics of the system.

## 5 Machiavellianism stability analysis

The evolution of the recurrence (1) depends of the matrix . But, in fact, its values are a priori unknown in the real applications, because in the system (1), only the values of external perturbations and the set of the answer described by the Machiavellian social interaction model are measurable. Since we do not know the dynamics behavior, we make use of an estimator in recursive form. The estimator is a function of the answer of the individual considering a specific test, that obeys a set of conditions established in probability sense.

The vector describes the real interaction of the individual in the environment and describes the optimal interaction conditions of some individual in the environment. So, the difference of and is described by a vector predefined by the variance of the random variables with respect its inputs and outputs. Formally, we have the following definition:

**Definition 2.** *An individual is Machiavellian uniformly asymptotically stable if*

$$\lim_{k\to\infty} \{\|\Psi_k^* - \Psi_k\|\} \to 0 \tag{4}$$

In agreement to Ash [1] this condition is true if $0 < \|\Psi_k^* - \Psi_k\| < \upsilon_k$, and $\underset{k\leq m}{lim}\ \{\upsilon_k\} \leq \varsigma_m$. If $\Psi_k^*$ is optimal in the Lyapunov sense, then $\Psi_k$ is good enough and we have $\underset{k\leq m}{lim}\ \{\varsigma_m\} \to 0$ and the set of answers of the individual are uniformly asymptotically stable too.

Arbitrarily we choose an estimator $\hat{A}$ and an identifier $\hat{y}_k$ able to describe a Machiavellian individual behavior. If we have a 2nd-probability moment with respect to $y_k$ such that the system described in (1) is bounded in recursive

sense, and we have that $\hat{y}_k$ (identifier) is Machiavellian bounded by the same probability moment, then $\hat{y}_k$ is uniformly asymptotically stable. In this sense, if we consider that $\hat{y}_k$ is Machiavellian stable and bounded by a recursive 2nd-probability moment and we have that $\hat{y}_k$ is also Machiavellian bounded by the set of answer of the same recursive 2nd-probability moment, as a result we have that the answer of the filter is asymptotically stable. $y_k$ will be bounded by the 2nd probability moment, because in the AR(1) model we chose in (1) the variance asymptotically converges in the 2nd probability moment.

It is important to note that the estimator filter $\hat{A}$ is stable if $\hat{y}_k$ is a Machiavellian bounded input. The stability exponent $\Lambda$ of $\hat{A}$ asymptotically converge. Then, $\hat{A}$ is asymptotically stable if it is bounded and, in other case, $\hat{A}$ is invariant in time sense. In addition, the estimator filter $\hat{A}$ could be asymptotically stable if it is bounded with respect to 2nd probability moment.

Moreover, the identifier filter $\hat{y}_k$ is asymptotically stable with respect a Machiavellian bounded input. The Kalman-Yakubovic-Popov lemma suggests that the stability exponent $\Lambda$ of $\hat{y}_k$ asymptotically converge. Then, $\hat{y}_k$ is asymptotically stable if it is bounded.

As a result let us consider the answer of the estimator $\hat{A}$ and the answer of the identifier $\hat{y}_k$ asymptotically stable with respect to the answers of the Machiavellian individual. Then the Machiavellian system is uniformly asymptotically stable if in agreement with Lyapunov:

$$\Psi_k^* = B_k^+ f(y_{k-1}; A_k; \Psi_k) - \hat{A}_k \ \hat{y}_{k-1}, \tag{5}$$

where $\Psi_k$ is bounded.

In this sense, let us consider

$$y_k = f(y_{k-1}; A_k; \Psi_k) \tag{6}$$

as a generic model with respect to (1).

Then, the vector input described by $\Psi_k$ is optimal if $\dot{\Delta}_k = 0$. Considering the error is described as

$$\Delta_k = |\hat{y}_k - y_k| \,, \tag{7}$$

Its gradient developed is $\dot{\Delta}_k = \hat{A}_k \ \hat{y}_{k-1} + B_k \Psi_k - f(y_{k-1}; A_k; \Psi_k)$,
and accomplished the optimal conditions with respect to input:

$$\Psi_k^* = B_k^+ f(y_{k-1}; A_k; \Psi_k) - \hat{A}_k \ \hat{y}_{k-1}, \tag{8}$$

where $B_k^+ := B_k^T (B_k^T \ B_k)^{-1}$.

Note that the matrix of estimated parameters $\hat{A}$ and the vector of identification states $\hat{y}_k$ established the stability conditions of the real system.

## 6 Error estimation

We consider that the convergence rate between the Machiavellian interaction model described in (1) and his identifier is bounded by the 2nd probability moment expressed by $J_n = E(\Delta_n \ \Delta_n^T)$ and converge asymptotically to the equilibrium point, i.e., $\lim_{n\to\infty} J_n = 0$. Where the identification error is $\Delta_n := |y_n - \hat{y}_n|$, $n \in \aleph$.

In this sense, let the 2nd probability moment be expressed in simple form as $J_n = \sum_{k=1}^{n} \Delta_k \ \Delta_k^T \ P(\Delta_k/\Im_{k-1})$. Considering that the set of identification errors we have $J_{n-1} = \frac{1}{n-1} \sum_{k=1}^{n-1} \Delta_k \Delta_k^T$
then, in recursive form with respect to $J_n$, we obtain

$$J_n = \frac{1}{n} \left[ \Delta_n \Delta_n^T + J_{n-1}(n-1) \right] \tag{9}$$

Considering that: $\Delta_n \in [0, 1)$, $\forall n \in \aleph$, then evidently $\lim_{n\to\infty} J_n = 0$ is true and $J_n$ decreases exponentially.

## 7 Estimator and Identifier Filters

In this section we will choose an estimator and an identifier able to fulfill the concepts described in previous sections.

From (2) and (3) we have an estimator using an instrumental variable such that $E\left\{\omega_k \ \upsilon_k^T\right\}$ and the interaction of the Machiavellian interaction in the environment is bounded by the 2nd probability moments:

$$E\left\{y_k \ \omega_k^T\right\} = (\Theta_\omega)^2, \ E\left\{y_k \ \upsilon_k^T\right\} = (\Theta_\nu)^2, \tag{10}$$

The matrix parameter estimator $\hat{A}$ using instrumental variable is described in recursive form:

$$\hat{A}_k = \left( \hat{A}_{k-1} T_{k-1}^{-1} + y_k \ \Theta_k^T \right) T_k^{-1} \tag{11}$$

where: $T_k^{-1} = E\left\{y_{k-1} \ \Theta_k^T\right\}$, and $\Theta_k^T$ is an instrumental variable such that it is a function of real interaction of the Machiavellian interaction $y_k$.

In accordance with the Machiavellian interaction model, the estimator described in (11) has an asymptotic convergence in agreement with definition 2. The model satisfies $A$, defined as the matrix gain of the internal properties of Machiavellian interaction model.

To guarantee the stability and the invertibility conditions it is necessary proceed with a dynamic following the behavior of the individual, given a specific environment and using an identification model. In general this kind of system

could be described by identification techniques, but in any case, each of them require the transition matrix or the estimation techniques.

The final goal of an identification model is to find a mean square stabilizing, minimum variance control law. To do this we note that by viewing as a state process, the conditional expectation $\tilde{y} = E\{y_k/\Im_{k-1}\}$ is computable using the Kalman filter, providing as result a Gaussian distribution.

In this case, the Kalman filter identification is obtained recursively by the following equations. Form (2) and (3) let $Cov(b\ \omega_k) = Q_k$ and $Cov(c\ \upsilon_k) = R_k$, then

$$\hat{y}_k = \hat{y}_{k-1} + K_k(\hat{A}_k - \hat{A}_k\ y_{k-1}), \tag{12}$$

where $K_k = \left(R_k + \hat{A}_k\ P_k\ \hat{A}_k^T\right)^{-1} P_{k-1}\hat{A}_k^T$, and $P_k = P_{k-1} - \left(R_k + \hat{A}_k\ P_k\ \hat{A}_k^T\right)^{-1} P_{k-1}\hat{A}_k\hat{A}_k^T P_{k-1} + Q_k$ .

## 8 Simulation Example

The Machiavellian social interaction model (1) and its error estimator $J_n$ is described in recursive form by (9).

In graphs 1a, 1b, and 1c is described the matrix parameter estimator $\hat{A}$.

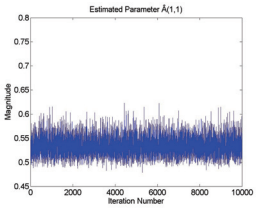


Figure 1a. Estimated Parameter (1,1)

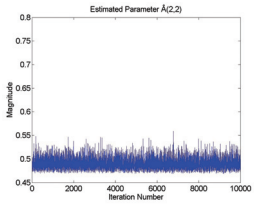


Figure 1b. Estimated Parameter (2,2)

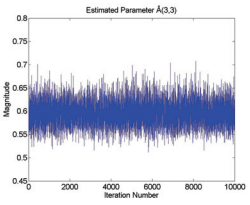


Figure 1c. Estimated Parameter (3,3)

In figures 2a, 2b and 2c we represented the estimated parameters for the variables tactics, immorality and views. The corresponding filtered graphs are presented in figures 3a, 3b and 3c.

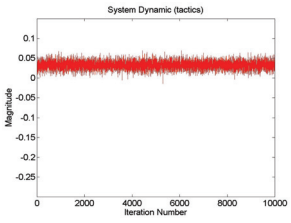


Figure 2a. System Dynamic (tactics)

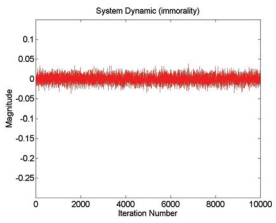


Figure 2b. System Dynamic (immorality)

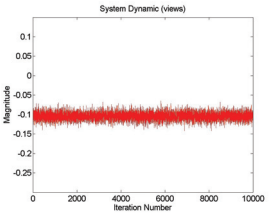


Figure 2c. System Dynamic (views)

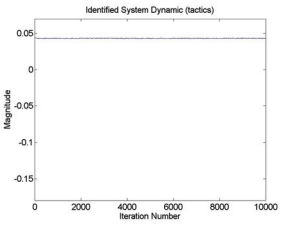


Figure 3a. Identified System Dynamic (tactics)

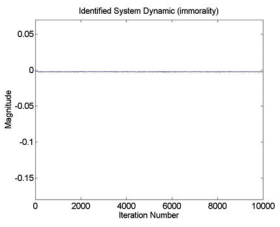


Figure 3b. Identified System Dynamic (immorality)

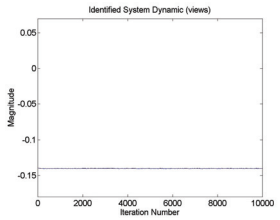


Figure 3c. Identified System Dynamic (views)

Machiavellianism could be conceptualized as being influenced by different variables. On the one hand, by the three concepts that define Machiavellianism ($M^3$): tactics, immorality and views (Figures 4a, 4b). These variables are correlated with the Machiavellianism, but have been shown to have no correlation between them, resulting in a diagonal transition matrix $A$.

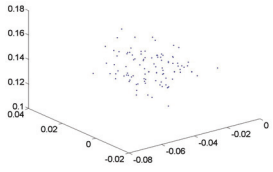

Figure 4a. Simulation with 3 variables (tactics, immorality, vision)

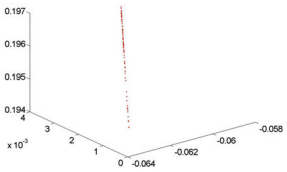

Figure 4b. Simulation filtered with 3 variables (tactics, immorality, vision)

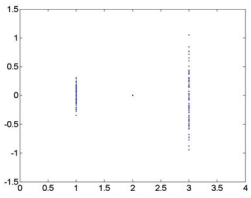

Figure 5a. Simulation with 3 variables (tactics, immorality, vision)

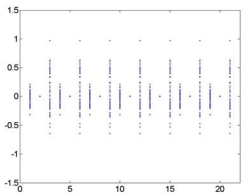

Figure 5b. Simulation with 21 personalities variables

On the other hand, Machiavellianism ($M^n$) is correlated with different personality variables like: aggression, achievement, dogmatism, conscientiousness,

trust, defensive, authority, exploitativeness, etc. These variables present a correlation between them that must be expressed in a transition matrix $A$ with nonzero off-diagonal elements of the Machiavellianism model (1). The eigenvalues obtain after diagonalizing such a matrix play the same role in the stability of the system as do the eigenvalues of a diagonal transition matrix.

The simulation of both scenarios is presented in Figure 5a and Figure 5b[1]. In both graphs we can establish a stability region between (-1, 1.1) and (-0.7, 1) respectively. So it is possible to suppose that Machiavellian $M^3$ and $M^n$ display a similar behavior, as we expected. Obviously, the graphs in figures 5b will be closed to the graphs in Figures 5a when the number of personality variables will be increased.

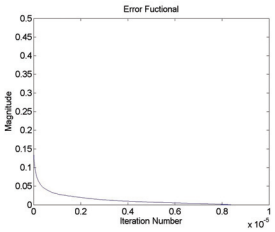


Figure 6a. Error asymptotically stable

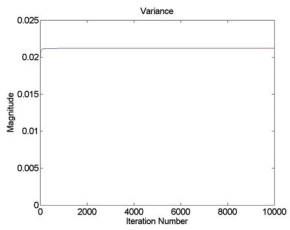


Figure 6b. Variance convergence

The error, represented in figure 6a, decrease monotonically for the three variables (tactics, immorality and views). So, the Machiavellian system is uniformly asymptotically stable, i.e. when the identifier index $k$ tends to infinity, $J_n$ tends to zero (9). In figure 6b we have a representation of the variance, where it is graphically shown that the Machiavellian system converges in its 2nd probability moment.

## 9 Conclusions and future work

A formal framework for stability analysis of the Machiavellian interaction social model has been presented. A new definition of Machiavellianism that extends the definition of Christie & Geis [3] was introduced. The stability of the process describing the behavior of the Machiavellian individual was analyzed in terms of mean and variance. We present the condition under which the error and the variance converge. The Machiavellian stochastic process was also described in terms of a filter as a descriptor of real processes. The simulation illustrates the applications of the Machiavellian procedure in practical data analysis. As future work it will be of interest to develop a software tool which will take care of the stability for real Machiavellianism life problems.

[1] Note that in the graphs the stability area of some variables is represented by points. This is related with the choice of the stable initial values of these variables for simulation purpose.

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