Simulations of Egoistic and Altruistic Behaviors Using the Vidya Multiagent System Platform

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ABSTRACT
This paper investigates the impacts of individual egoistic and altruistic behaviors in a virtual society built upon the Vidya game, used here as the social simulation and Multiagent System (MAS) platform. The Vidya game was adapted to support *Jivas*' (autonomous intelligent agents of the Vidya game) social behavior, including formation of reputations, creation of clans and 'co'-action based on leadership. The evolving society of *Jivas*, using the above mentioned social behaviors, becomes an ordered and complex MAS. The experiments carried out demonstrate the impacts of individual altruistic and egoistic behaviors on society and emergence of social order through time as an important and desirable event in open MAS and societies.

Categories and Subject Descriptors
I.2.11 [**Artificial Intelligence**]: Distributed Artificial Intelligence – *Multiagent systems, Intelligent agents*; J.4 [**Computer Applications**]: Social and Behavioral Sciences – *Sociology*; I.6.8 [**Simulation and Modeling**]: Types of Simulation – *Gaming*; K.8.0 [**Personal Computing**]: General – *Games*;

General Terms
Algorithms, Experimentation, Verification.

Keywords
Altruistic behavior, egoistic behavior, open MAS, reputation, social emergent behavior, social simulations.

1. INTRODUCTION
Simulations that use Multiagent Systems (MAS) [1] are very useful for verifying and analyzing outcomes that arise from the social interactions of each individual agent. In such systems, we argue that the observed (macro-level) emergent behavior consists of a miscellany of egoistic and altruistic behaviors of every autonomous intelligent agent (micro-level).

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It is not difficult to accept that there are many practical applications for this kind of work. For example, researchers from the Social Sciences can better understand: (i) how selected collective behaviors emerge, (ii) how global order can be achieved from local interactions in open societies (*i.e.* societies that are loosely regulated) and (iii) how micro and macro (social) levels relate to each other (*i.e.* how important interactions between individuals are in the explanation of complex social phenomena). This interdisciplinary approach (*i.e.* Computer and Social Sciences) has been developed by German and other researchers since 1998, under the new name of *Socionics* [2].

This paper contains simulations of a society of individual intelligent agents that inhabit an artificial world referred to as Vidya [3]. Simulations were carried out utilizing the Vidya game engine as a social behavior platform.

2. THE VIDYA GAME
Vidya is a single-player (single human player) strategy and god-like game, placed in an environment where virtual beings, such as sheep, wolves, cows, etc., compete for available natural resources within a single simulated ecosystem. Among the many types of beings that inhabit the virtual world, there is a special one called *Jiva*. *Jivas* are intelligent agents designed to be autonomous and to survive against all odds, whose actions are devised through evolutionary computation [4].

In the initial version of the Vidya game [5], two clans of *Jivas* dispute the supremacy of the game world. One of these clans obey the player's instructions. The player is invited to be the clan's *Deva* (*i.e.* the clan's god) and the one who provides guidance to its members.

The intelligence of *Jivas* evolves over time and increases their knowledge of the world. The *Jivas* autonomously learn from their own experience, evaluating whether a given action at a specific time was appropriate.

2.1 The *Jiva*'s Intelligent Decision Module
It is easy to deduce that the basic problem of *Jivas* is to perform well in the environment for a given limited perception.

In general terms, what they do is try to maximize a gain function, which is the *Jiva*'s general vital condition (GVC)[1].

The task of the *Jiva*'s intelligent decision module is to select (or decide) the best action to be performed by the *Jiva*'s agent. This action selection is then performed by genetic algorithms [6]. Actions are single-mapped to individuals (or chromosomes) of the GA population, which is a subset of all available actions.

Normally, one *Jiva* has a large set of available actions that can be performed. The selection of the best one can be very time consuming if traditional search methods are used. With GA we narrow down the search space and the choices converge towards the best action rapidly. This process produces a good candidate solution even within few GA generations.

The *Jiva*'s perception consists of a set of world objects and their characteristics such as type and positioning in relation to the *Jiva*. The *Jivas*, after perceiving the environment, create internal representations for every object within their perceptive square. Next, they will select a good action considering all perceptive information. An action is defined as the destination cell to which the *Jiva* will move. Thus, we characterize an action by a coordinate pair (x, y), meaning that the *Jiva* will move to that position in the next time step, as shown in Figure 1.

Figure 1. Destination cell to which the *Jiva* will possibly move. Observe that there is a cell selected with a fruit on it; the *Jiva* may want to eat it.

2.2 Surviving through EC

The GA has the role of selecting the best action for a given perception, following the natural selection method that characterizes a GA. This includes evaluation, cross-over and mutation of individuals.

The *Jiva*'s intelligent decision module stores one GA instance per perceptive state. The evolution of a given GA instance occurs when *Jiva* reaches the associated perceptive state, performing the evolutionary operations of selection, cross-over and mutation. One space of action (*i.e.* many possible actions) is evaluated in order to tune the *Jiva's* behavior to that specific perception.

[1] The *Jiva*'s general vital condition (GVC) is a weighted average of its vitality – the remaining life time of the *Jiva* -, hydration – the level of water of the *Jiva* – and energy – the level of nutrition of the *Jiva*. Ultimately, the GVC represents the adaptability of the *Jiva* in an environment and, indirectly, its intelligence.

When evaluating an action, the GA might care not only about its immediate cost, but also infers its long term cost. We will refer to this long term evaluation as an evaluation "*F* steps in the future", where *F* is the number of steps that the GA will be able to see in the future to estimate the long term cost.

The selection method used to choose pairs of actions that will crossover is the roulette wheel [7]. Pairs of actions are then selected and crossed-over, producing new actions that will comprise the next generation of the population. The mutation operator is also applied to the population. The mutation probability was arbitrarily set to $1/32^{nd}$, that is, on average, for every 32 actions 1 is likely to be mutated.

The number of chromosomes of the GA populations and the future steps that the intelligence module infers are parameters of the proposed algorithm. The initial experiments of the Vidya game demonstrated that the best parameter setting is 192 chromosomes in the population and the ability to produce long term evaluation of 2 steps in the future [5]. This setting is a compromise between the *Jiva*'s intelligence and the computational performance of the algorithm.

3. SOCIAL BEHAVIOR

Behaviors are sets of actions and reactions that organisms (or agents) perform in a given environment, stimulated by specific purposes. Social behavior is what happens when organisms of the same specie interact and communicate with each other, sharing common characteristics and desires. We are particularly interested here in the individual egoistic and altruistic characteristics of social behavior and their implications at the social macro-level.

An overview of the main types of assets involved in interactions between agents will help in the understanding of egoistic and altruistic actions. This is seen in Subsection 3.1. Subsection 3.2 provides an overview of the multi-level social organization, another decisive factor in the agent's behaviors. Subsections 3.3 and 3.4 explain in more detail egoistic and altruistic behaviors, respectively.

3.1 Types of Assets

Assets are the central point in any relationship between agents, meaning any kind of resource that confers power or status to an agent that can become a common object of desire. Agents are entities that perceive the environment and act on it, by attempting to minimize a cost function that informs the agent how good its action is [8].

The interesting classification of different sorts of capital, which we preferred to refer to as assets, originally proposed by Pierre Bourdieu [9] is as follows: *economic* assets; *cultural* assets; *social* assets; *symbolic* assets.

- Economic assets refer to financial resources, property rights or material resources that in a (real) society can be easily convertible to money.
- Cultural assets are related to professional skills, educational qualifications (*e.g.*, diplomas, certificates) and cultural goods.
- Social assets come from durable social associations of agents such as groups, families or institutions.

- Symbolic assets are the ones that emerge from social interactions and are referred as such because they have no direct relation with material resources of an environment. They constitute a status or desired characteristic conferred to an agent supplied by the others and are disseminated through communication and can only be tackled by comparative analyses between the agents of a society [9].

3.1.1 Social Reputation

An important kind of symbolic asset is the social reputation, defined here as a socially disseminated opinion about trustworthiness of agents which are part of an open MAS (*i.e.* an MAS without any explicit order mechanism). This helps to promote a flexible self-regulation and, consequently, social order, representing a judgment value communicated in a society that evaluates the agents' trustworthiness [9].

Social reputation is also assigned to groups of agents, not only to individual agents [10]. The process of assigning social reputation to a group is dependent on the trustworthiness of each agent that belongs to that group. In a recurrent manner, the reputation of an agent is assigned also considering the reputation of the group, which he belongs to. If an agent is trustworthy by himself, but the group that he belongs to is reputed to be untrustworthy, the agent reputation will be harmed.

3.2 Multi-layer Social Organization

A society is almost always visualized as a set of individuals that present homologous characteristics. On a closer look, a society is a much more complex system than that. It is composed of individuals with particular characteristics that aggregate themselves in groups, forming a multi-layered compound. The society itself – considering that it is the whole set of individuals – belongs to an ecosystem, which is a more complex entity with its distinct global dynamics.

In a simplified manner, we can view the multi-layered social environment as a composition of these elements: *Society, Group* and *Individual*.

- The society element is the society itself as a whole, made of a set of group elements.
- The group element is an abstract concept, indicating the intermediate layers of the society. Groups can consist of other groups or individuals, and can be also viewed within a hierarchical structure. The ones at the lowest layer can aggregate and form groups of higher social status. Groups also share social assets.
- Individuals are the building blocks of societies. In their composition, they form social groups.

3.3 Egoistic Behavior

Egoistic behaviors are actions of social elements that are motivated by self-interested asset gains.

There are many arguments and doctrines that defend egoism, some of which are explained in Subsections 3.3.1 and 3.3.2. Subsection 3.3.3 details one type of egoist behavior, competition.

3.3.1 Psychological Egoism

Those who defend Psychological Egoism [7] say that healthy humans always behave in a self-interested way, even when the actions seem to be altruistic ones. Thus, Psychological Egoism argues that altruism is merely apparent and that all behaviors are motivated by personal gain.

Following this line of thought, even if a person acts in a way that benefits others without gaining any visible asset, the "good feeling" that he experiences in performing this type of action functions as a type of asset (emotional asset) and, is thus self-interested. The apparently altruistic act can also be motivated by the acquisition of a good reputation, expectation of reciprocity or even religious beliefs (*e.g.*, reward in the next life, going to heaven after death, etc).

The Psychological Egoism argument seems to be very sound, but it contains a number of pitfalls that invalidate it as a scientific theory.

First, it is non-falsifiable. For example, the hypothesis of the "good feeling" that people experience in performing (apparently) altruistic actions cannot be detected (apart from pure actor introspection); it cannot, therefore, be proved that all people experience it.

Second, the Psychological Egoism argument uses circular logic. For example, in considering that all altruistic people are in reality egoistic because they feel good with this kind of action and, hence, concluding that these people are egoistic, does not prove anything. In fact, the conclusion is equal to the hypothesis, thereby characterizing circular logic.

3.3.2 Rational Egoism

The Rational Egoism argument states that pursuing personal interests is rational, and not pursuing personal interests is not rational [11]. Rational Egoism assumes that irrational behaviors can exist, for example, when motivated by emotional impulses or fantasies. Insane people also can act irrationally.

There is a variant of Rational Egoism, Adaptive Egoism, which states that a shared gain in a group or society can be pursued by an individual. The Adaptive Egoism proponents say, for example, that replacing Rational Egoism arguments by the Adaptive Egoism ones in a political or economical system would produce a better social organization.

3.3.3 Competition

Competition is a process of dispute for assets in a shared environment. Considering elements of the same society, competition can be understood as a mutually egoistic behavior.

When an asset cannot be divided, or it is not sufficient for all, competition takes place. In a competitive process, actors follow strategies that aim at maximizing their chances of gaining the desired asset.

3.4 Altruistic Behavior

In contrast of egoistic behaviors, altruistic behaviors are the ones that are not motivated by personal asset gains, but by the gains for others. Most commonly, altruistic actions are taken by the individuals of the same group that the actor is part of.

When observed from the multi-layer social organization point of view, altruistic actions at a given layer can symbolize egoistic actions with respect to others. For example, in the real world, when soldiers are at war, they sacrifice their lives in favor of their nations; this can be seen as altruistic behavior at the individual level, but as an egoistic action at the nation level that obtained gains at the expense of the soldiers' sacrifice.

The multi-layer social organization point of view is the best way of observing the emergence of these apparently contradictory behaviors (egoistic and altruistic behaviors). A behavior that seems to be irrational at one social layer becomes perfectly rational at an upper organizational layer.

3.4.1 Cooperation

Cooperation is the concept that is the opposite of competition. If competition arises from a mutual egoistic scenario, cooperation arises from a mutual altruistic one.

However, these two concepts are only in apparent contradiction. Actually, groups of cooperative work can represent, at a higher social layer, a competitive element. In other words, the need for competition motivates individuals to organize themselves in cooperative groups to form stronger competitive forces.

4. SIMULATING SOCIAL BEHAVIOR IN THE VIDYA GAME

In this section, the adaptations carried out in the original implementation of Vidya required for supporting social behavior simulation are explained. These changes are aimed, primarily, at incorporating the possibility of accounting for egoistic and altruistic characteristics present in the *Jivas*' behaviors.

The whole set of *Jivas*, in the social behavior simulation context, represents a society. Computationally speaking, this simulated society is an open multi-agent system (MAS), with the following restrictions: (i) it does not possess any kind of macro-level behavior control for promoting order and (ii) order emerges from the autonomous behaviors of individuals. These two restrictions were observed to guarantee the quality of the simulation results.

Three specific social behaviors were added to the *Jivas* for implementing the above mentioned local order mechanism. These are the following: reputation formation; clan creation; formation of 'co'-action contexts based on leadership.

The following subsections explain in detail the three social behaviors added to the *Jivas*.

4.1 Reputation Formation

The social reputation concept was explained in Subsection 3.1.1. In the Vidya social behavior simulation, reputation is directly related to the egoistic and altruistic behaviors of the *Jivas*. Each *Jiva* store his opinion about the known *Jivas* and clans.

When one *Jiva* knows other nearby *Jivas*, he updates their reputations based on the benefits that he obtained in the presence of those *Jivas*. If the *Jiva* GVC is increased, he associates this increase to the altruistic behaviors of the *Jivas* present, and thus also increases their reputations (in his own opinion). Otherwise, the *Jivas*' reputations are decreased, because they are associated with egoistic behaviors.

Based on previous reputation evaluation, the *Jiva* changes his mind about the reputation associated with the clans of all other evaluated *Jivas*. A clan reputation is the arithmetic average of the known *Jivas* reputation of that clan.

After evaluating the clans' reputations, the *Jivas*' reputations are evaluated again. Now, the new reputation of an evaluated *Jiva* will be the arithmetic average of his personal reputation and the reputation of the clan to which he belongs.

After that, each *Jiva* will communicate his reputation opinions (about other *Jivas* and clans) to the nearby *Jivas* (those that are inside his perceptive rectangle). When a *Jiva* receives the reputation values from other *Jivas*, his reputation opinions will be changed once again. He will performs a weighted average of his own opinion and the other *Jivas* opinions, producing new reputation values for all (*i.e. Jivas* and clans).

4.2 Clan Creation

A *Jiva* exhibits a wish to form a clan with other *Jivas* if the former is benefited somehow by the latter. If the benefited *Jiva* already belongs to a clan, he sends an association invitation to the other.. In contrast, if the benefited *Jiva* does not belong to a clan, he sends a clan creation invitation to the other.

The *Jiva* that receives an association invitation will behave as follows: if he already belongs to a clan, he compares the inviter clan's reputation with that of his own clan. If the inviter clan reputation is greater than his own, he accepts the invitation. If he still does not belong to a clan, he compares the inviter clan reputation with his personal reputation. If the inviter clan reputation is greater than his personal reputation, then he accepts the invitation.

If neither the inviter nor the invitee belong to a clan, the invitee compares the inviter reputation with his reputation. If the inviter reputation is greater or equal than his reputation, the invitee *Jiva* accepts to initiate a new clan with the inviter. In the case of many invitations, the invitee chooses the one who is the best.

4.3 'Co'-action[2] Contexts based on Leadership

A *Jiva* tends to follow the actions taken by another *Jiva* of the same clan that is being perceived by the former as possessing the better reputation (i.e. the leader). The *Jiva* sociability will define how many others he considers influential in his own decisions.

Let's suppose that a *Jiva* is at a given location in the world and is capable of perceiving a set of *Jivas* that belong to his clan. For the formation of 'co'-action contexts based on leadership, this *Jiva* needs, firstly, to evaluate the reputation and intelligence of each perceived *Jiva*. The *Jiva* that possesses the greatest combination (including the perceiver *Jiva*) is considered the leader of that 'co'-action context.

[2] 'Co'-action is defined as a type of individual action whose purpose is motivated by actions performed by agents with greater social prestige. Prestige is here represented as a combination of intelligence and reputation. In 'co'-action contexts, individuals are not forced to perform an action by the ones that have more prestige, but just stimulated to follow them.

If one *Jiva* is the leader, then he will not be influenced by other *Jivas*, but distribute suitable tasks to them based on their reputation-intelligence combination. *Jivas* that have better reputations and are more intelligent receive the most important tasks. These distributed tasks may or not be performed by the *Jivas*, although they are strongly encouraged to perform them; here also *Jivas* have autonomy to choose what they are going to do.

5. EXPERIMENTS AND RESULTS

The experiments carried out show the impact of individual egoistic and altruistic behaviors on the *Jiva*'s society. The *Jiva*'s reputation here indicates degrees of either egoism or altruism – individuals that have a higher reputation are seen by the society or clan as altruistic individuals.

The Vidya's initial configuration used in all experiments was as follows:

- The simulation world was a rectangle of dimensions 150×150;
- Vidya ecosystem, excluding *Jivas*, consisted of: 10 trees, 8 fruits, 5 plants, 7 sheep, 5 wolves, 5 cows, 3 dead trees, 3 tree roots, 2 dead sheep, 2 dead wolves and 2 dead cows. Stones (10 units) and water spring (10 units) were also inserted into the ecosystem as additional objects. All objects were inserted in random positions in the world;
- 20 *Jivas* were inserted in the world in random positions. All *Jivas* were initially unrelated, that is, no clan was already formed;
- The *Jiva*'s intelligent decision module was made up of GA instances of populations of 192 chromosomes and can infer 2 future steps.

The simulation lasted for 10 minutes (real world time). It was repeated 30 times, from which we selected 5 execution instances that characterize 5 different social formations. The state of the *Jivas*' population was verified at 1 minute intervals.

Figure 2 and 3 show the growth of the *Jivas*' average reputation and the standard deviation of the *Jivas'* reputation, respectively, as a function of time. The observable fast growth is not well distributed among *Jivas*, as the growth of the standard deviation of the *Jivas*' reputations shows. This means that some individuals formed their reputation to a great degree, while others acquired a very low reputation.

An interesting emergent social order behavior occurs when the reputation mechanism is used to regulate social interactions between agents. We observed this on analyzing the stable growth of the *Jivas*' average GVC, as shown in Figure 4. The observed growth is completely justified by the following arguments: (i) initially, there is a high availability of natural resources, so *Jivas* eat more and increase their GVC; (ii) gradually, the *Jivas* reach a dynamic equilibrium with the ecosystem and the natural resources become scarcer.

The *Jivas*' average GVC growth shown in the graph in Figure 4 is an indication that the social behaviors embedded in the *Jiva*'s intelligent decision module (formation of reputation, creation of clans and 'co'-action contexts based on leadership) are a good distributed control mechanism for MAS.

It is easily observable in the graph in Figure 5 that the standard deviation of the *Jivas*' GVC, up to 2 minutes, has a fast growth trend, after which, all curves reach a dynamic equilibrium process, with a light tendency to decrease with the passage of time. This stable configuration emerges using the above mentioned embedded social behaviors. The social reputation mechanism helps to build a good resource distribution among the *Jivas*, even if the reputation asset is naturally disproportionately distributed.

Figure 6 shows the evolution of altruistic individuals in the *Jivas*' society. The social reputation mechanism helps, at the macro-level, in the observed self-regulation process. Notice the almost cyclical pattern that has emerged.

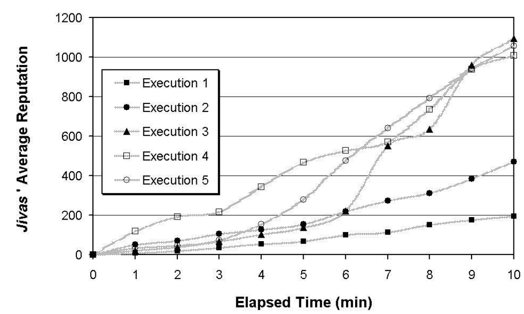

Figure 2. *Jivas*' average reputation growth over time.

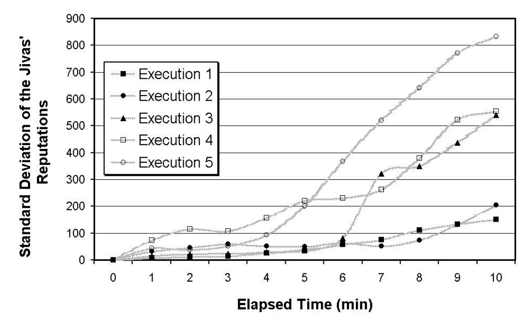

Figure 3. Standard deviation growth of the *Jivas*' reputation over time.

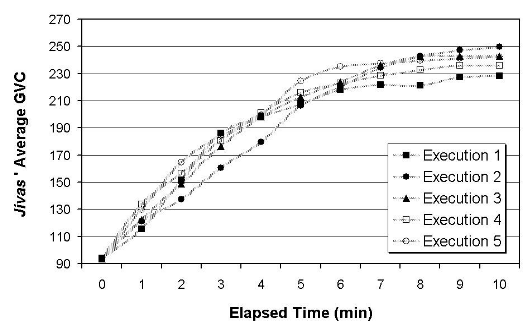

Figure 4. *Jiva*s' average GVC growth over time.

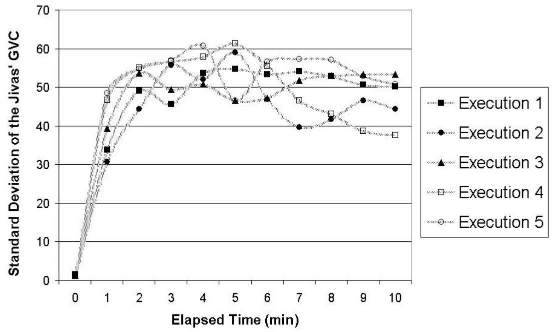

Figure 5. Standard deviation of the *Jivas*' GVC over time.

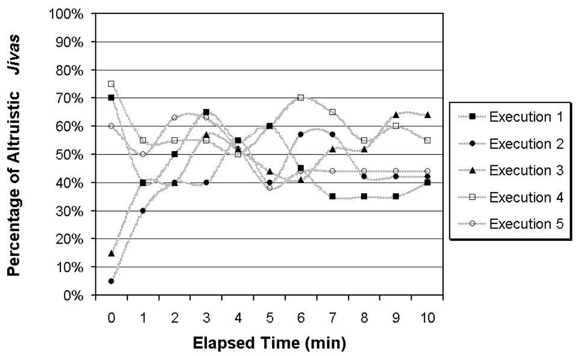

Figure 6. Percentage of altruistic *Jivas* over time.

6. CONCLUSION

The present paper shows the emergence and impacts of individual simulated egoistic and altruistic social behaviors, using the Vidya game as a multiagent system simulation platform, based on the concepts of social reputation, formation of clans and 'co'-action contexts based on leadership. Based on the experiments and their results explained in Section 5, we conclude that:

- Social reputation is disproportionately distributed among members of the *Jivas* societies. Some individuals have a very high reputation in relation to the remaining population, which has a very low reputation;
- The use of reputation as a social order mechanism can produce fairer distribution of resources among the *Jivas* population;
- The number of individuals considered altruists in the simulated societies stabilizes in the course of time in a oscillation nearer to the mean term (50%), revealing that this is the equilibrium point of the simulated society.

With due care, the above mentioned conclusions can be carefully extended to real societies. Obviously, the Vidya social simulation platform is much less complex than a real social environment and can not match it perfectly, but these simulations can be set to approximate particular aspects of human social behavior.

We conclude by standing that it is likely that in other domains, where individual gains also imply group gains, what we have observed here may apply.

7. ACKNOWLEDGMENTS

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8. REFERENCES

[1] Weiss, G. Multiagent Systems: A Modern Approach to Distributed Artificial Intelligence. London: The MIT Press, 1999.

[2] Malsch, T. and Schulz-Schaeffer, I. *Socionics: Sociological Concepts for Social Systems of Artificial (and Human) Agents*. Journal of Artificial Societies and Social Simulation, volume 10, n° 1, 2007. Available at: http://jasss.soc.surrey.ac.uk/10/1/11.html (Accessed: 2007-03-13).

[3] Pita, M.R.S.P. *Vidya: Um Jogo de Estratégia com Intuição e Inteligência Artificial*. Final year Graduation Project, Presented to the Department of Computing Systems, Polytechnic School of Engineering, Pernambuco State University, Recife, Brazil, 2006. (In Portuguese)

[4] Eiben, A. and Smith, J. *An Introduction to Evolutionary Computing*. Berlin: Springer, 2003.

[5] Pita, M.R.S. and Neto, F.B.L. *Vidya: A God Game Based on Intelligent Agents Whose Actions are Devised Through Evolutionary Computation.* In: *Proceedings of the IEEE Symposium on Computational Intelligence and Games*, Hawaii, USA, April 1-5, 2007.

[6] Goldberg, D.E. *Genetic Algorithms in Search, Optimization and Machine Learning*. New York: Addison-Wesley, 1989.

[7] Jinghui, Z. *Comparison of Performance between Different Selection Strategies on Simple Genetic Algorithms*. In CIMCA, vol. 2, 2005, pp. 1115-1121.

[8] Russell, S. and Norving, P. *Artificial Intelligence: A Modern Approach*. Englewood Cliffs, NJ, Prentice Hall, 1995.

[9] Hahn, C., Fley, B., Florian, M., Spresny, D. and Fischer, K. *Social Reputation: a Mechanism for Flexible Self-Regulation of Multiagent Systems*. Journal of Artificial Societies and Social Simulation, volume 10, n° 1, 2007. Available at: http://jasss.soc.surrey.ac.uk/10/1/2.html (Accessed: 2007-03-13).

[10] Hales, D. *Group Reputation Supports Beneficent Norms*. Journal of Artificial Societies and Social Simulation, vol. 5, n° 4, 2002. Available at: http://jasss.soc.surrey.ac.uk/5/4/4.html (Accessed: 2007-03-28).

[11] Shaver, R. *Egoism*. The Stanford Encyclopedia of Philosophy (Winter 2002 edition), 2002. Available at: http://plato.stanford.edu/entries/egoism/ (Accessed: 2007-03-28).