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A Model of Decision-Making Based on the Theory of Persuasion used in MMORPGs

Helio C. Silva Neto, Leonardo F. B. S. de Carvalho, Fábio Paraguaçu, and Roberta V. V. Lopes

Abstract—From a videogame perspective, decision-making is a crucial activity that takes place at all times and at different levels of perception. Moreover, this process influences the gamers' performances, which is an interesting feature for RPGs as they are games that are able to work as tools for increasing the improvement of the proximal development zones of players due to their inherent trait of cooperation, which alone, stimulates their skills of socialization, interaction and, consequently, communication. A feat that is achieved by involving players in a kind of plot that requires them to interact and take decisions, hence, favoring decision-making process. For these reasons, the RPG genre was considered as an appropriate test bed to apply the decision-making model proposed by this paper, which was built by using a Petri Net and that combines concepts taken from The Game Theory and from the reciprocity principle from the Theory of Persuasion.

Index Terms—Psychology of persuasion, systems decision making, MMORPG, RPG, Petri net and game theory.

I. INTRODUCTION

At any given time, a person might have to decide over different situations and problems. At those moments, people are likely to use past experiences, values, beliefs, knowledge, or even technical skills to take such decisions. While some people are more conservative, others might have an innovative character and be more willing to accept potential risks [8].

In videogames, making decisions is a crucial matter that must be performed at all times and at different levels of understanding, thus, having a direct influence on a player's performance. In fact, the decision making-process so important that is impossible to think on videogames without considering its occurrence [8].

To ease the decision-making process, this paper employs concepts taken from the Game Theory. The Game Theory of models focused on the analysis of conflicts and of situations that depend of strategic behaviors that, partially, restrict the player's actions. Here, this theory is used to trigger the change of state of a Petri Net, which, is employed in this paper as a tool to model the decision-making process of human players and the different outcomes their decisions might have as they

try to maximize their gameplay in a MMORPG (Massively Multiplayer Online Role-Playing Game) [5] [6].

In addition to those theories, this paper also employs the Reciprocity concept found in the Principle of Persuasion as a tool to aid human players to persuade each other in order to achieve their personal goals. In that, players use their communication skills as artifice to make other players voluntarily change their attitudes, beliefs or behaviors, thus, avoiding coercion. In other words, the person that is using of persuasion convinces other players to accept a particular idea. Is at this moment that the Reciprocity principle might stand out as it has an inherent meaning of a passed down obligation, which might be applicable to different circumstances [3].

Therefore, this paper models all these different theories and adapts them to a Role Playing Game (RPG) as a way to stimulate them in the creation of their strategies and in the decisions they make to achieve their goals, i.e. their knowledge. In that respect, the objective of this paper may be established as to elaborate a decision-making model (that is applicable to a MMORPG and that is grounded on the Reciprocity concept from the Theory of Persuasion) as a way to promote the interaction of various human players in a environment that favors the acquisition of knowledge, at the same time that permits the application of concepts taken from the Theory of Persuasion and of the Game Theory to aid players in their respective decision-making and in building their own knowledge.

To present this, this paper is divided into five sections. First, as to easy the readers understanding, it is necessary to detail some of the concepts of the RPG genre, including its digital versions, especially, the MMORPG. These subjects are the focus of the second section. Next, the third section presents a discussion regarding concepts of the Theory of Persuasion and of the Principle of Reciprocity.

The fourth section present the authors' model, particularly, how the Reciprocity Principle acts on the game environment, therefore, analyzing the procedures the Petri net implements for this principle. At last, the fifth section presents this paper's final conclusions in respect to the proposed model, noting that such discussion does not have the intention to exhaust the subject presented here, but rather, to emphasize the importance of using the Game Theory and of the Principles of Persuasion in a RPG environment as devices to attend the need human players might have in taking their decisions and searching for knowledge during their gameplay experience.

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II. MASSIVELY MULTIPLAYER ONLINE ROLE-PLAYING GAME (MMORPG)

The RPG (Role Playing Game) acronym was first appointed in the USA by Dave Arneson at the year of 1973. The situations taking place in a RPG are mainly described by speech representation and by using the players' imagination during the game sessions, which are usually the continuation of an adventure interrupted at a previous session [10] [11] [2].

Like many activities, the RPG has its own language. An example of this is the storyteller being referred as master, the listeners/participants being called of players and the story itself being called adventure. The basic concepts of the RPG are listed below, according to the work found in Debbie [7]:

- Player: the players are the ones in charge of one or more characters (known as PC, player character) of the plot and has freedom of action on the game scenario through his or her character within what is allowed by the game's system of rules;
- Game Master: has control over all factors related to the settings and plot that do not involve the characters' actions (which are exclusive to players). Has control of plot characters that interact with those controlled by the players (NPC Non-Player Character). It also has control over the settings, being able to adjust the game plot according to its needs; and is the sole responsible by the secret objectives of the plot and its progress. Like the others involved, the game master must follow and uphold the system of rules, yet, for the benefit of the plot, is able to change things within a reasonable logic;
- System of Rules: the actions taken by the players' characters are addressed to the game master, who verifies at the system of rules which is the result for the action performed by this character in the circumstances applied to it. Thus, there are different specific rules for different situations, and specific indications that must be taken into account to deal with unexpected situations. Characters: characters can be built by their own players or provided for the game. However, they must be elaborate in respect to the system of rules and the game scenario. All players are assigned with abilities that define their interaction with the environment. These skills are in accordance with the game's system of rules and achieved by the players as a reflection to their interest in building a particular kind of character;
- NPCs (Non Player character): The term is borrowed from other RPGs to indicate a character that is not controlled by any player, thus controlled by the game master. They usually act as supporting characters for the adventure;

With the release of computer RPG games, which allowed for a multiplayer mode of the game, i.e. allows multiple users to play on a LAN, modem or the Internet, the following characteristics made themselves common in digital RPGs played on Internet:

- Multiplayer interaction;
- Exploration of wide worlds provided with large locations;
- Existence of several sub-plots, allowing the players to create their own history and adventures;
- A great RPG's similarity to the table, because the permission of creation and evolution of the characters;
- For the large majority of games, the user can customize its main character, for example, creating adventures, items, weapons and worlds.

The MMORPGs have as main characteristic the constant intervention of a team of Game Masters, which may be NPCs or human developers in the real world, who work on plots and create challenges for the players' characters. The plots are nonlinear and thus they do not have a beginning, middle or even an end. The concept is that exist a virtual world to be explored, an open story. Another feature of MMORPGs is related to its own name and its idea Massively Multiplayer Online Role-Playing Game that allows for thousands of players together interacting in the "virtual" world.

III. THEORY OF PERSUASION

According to Robert Cialdini [3], persuasion is the use of communication to change the attitudes, beliefs or behaviors of others. However, this change must be voluntary and not through use of force or coercion. Thus, the person using of persuasion convinces the ones it communicates to in accepting a particular idea.

In that sense, the persuasive speech aims to embody "the whole truth" by using of linguistic resources and selecting expressions of "truth" able to introduce a particular assumption. Moreover, the ultimate goal of persuasive speech is to use rhetorical devices in order to convince other people to change their already established attitudes and behaviors [4]. There are six distinct principles of persuasion, each of them comprising a specific characteristic of human interaction. This paper however, focuses exclusively on the Reciprocity Principle, which will be discussed next.

A. Reciprocity

The relevant aspect of the reciprocity principle is the sense of obligation passed down from one person to another and that is ubiquitous in human culture. In this respect, a number of sociologists, such as Alvin Gouldner [9], state that there is no human society that fails to this rule. Furthermore, the archaeologist Richard Leakey [13] gives the essence of what makes the human species prone to reciprocate "We are human because our ancestors learned to share their food and their skills in a community network".

Competitive human societies respect the principle of reciprocity and thus, expect its members to respect and believe in this principle as well. In this sense, as every person was taught to live by this rule the social sanctions and scorn that may be applied on those who violate it are commonly known by everyone. In this sense, people who do not comply by this rule are assigned with derogative labels such as "ungrateful" or

“deadbeat”, which is a consequence of the unpleasant feeling generated in members of a society by those individuals that are seen as taking a “favor” and refusing to make any efforts to repay it.

Therefore, one of the reasons that make the reciprocity principle so effective is that the rule it stands for is imbued by a force, which often produces a “yes” response to a request that, in lack of a debt, would certainly have been denied. The strategies for applied by reciprocity are plain in appearance, yet extremely efficient and almost undetectable being that, the best solution in fighting them is to think before accepting any favor or concession from someone whose true intentions are unknown. Even though this might sound as a standard practice for exploiting (as a way to manipulate and influence) the reciprocity principle is a fundamental pillar of human society, and one of the reasons for the development of the earliest human communities.

IV. A MODEL OF DECISION-MAKING BASED ON THE THEORY OF PERSUASION

Now that the basic formalisms of the MMORPG and of the Reciprocity Principle from the Theory of Persuasion have been presented (respectively by sections 2 and 3) these concepts can be properly modeled to fit the context that a MMORPG presents.

A. Binary Decision Tree

A MMORPG game environment is prone to present different circumstances where the Reciprocity Principle might be applied, a fact that is due to the MMORPG approach that mixes the real world with a surreal one. Some examples of circumstances found in such games that support the use of strategies based on the Reciprocity Principle are:

- Aid in hunting monsters, locating an item or even completing a given Quest¹, all of which might help a player to increase its level. In those circumstances, the person receiving help will be in debt to the helper, which allows an exchange of knowledge;
- Tips and advice received via forum. Like the above circumstance, the player being aided will be in debt to the ones who made the post as well as to any other helper;
- Providing discounts on sales of some item. In these cases, it is possible that the given discounts are not available anywhere else. Thus, announcing the discounts is likely to attract buyers. These situations may require a little “push” from the seller, or be bounded to acquisition of certain X value resulting in an N discount. The same rules apply to promotions and contests;
- Regular buyers get discounts, thus, creating a loyalty bond.

1) Reciprocity principle and the flow module modeled in Petri net

The Reciprocity works as an exchange of favors, i.e. it consists of sharing what was received. In a MMORPG environment this principle might be triggered in several ways, some of which were described in Sec. 4.1. In order to provide a better understanding of the principles that this model applies to the environment, it has its operational flow depicted in Figure 1.

The flow of Figure 1 shows that the Reciprocity Principle is triggered in any circumstance in which, a player asks another one for a different set of simple aids, such as finding an item, completing a *Quest* or help in hunting a monster. For these requests, players have the additional aid of tools for creating a *Party*² and for *Trade*³ an item, all of which are identified on the above figure.

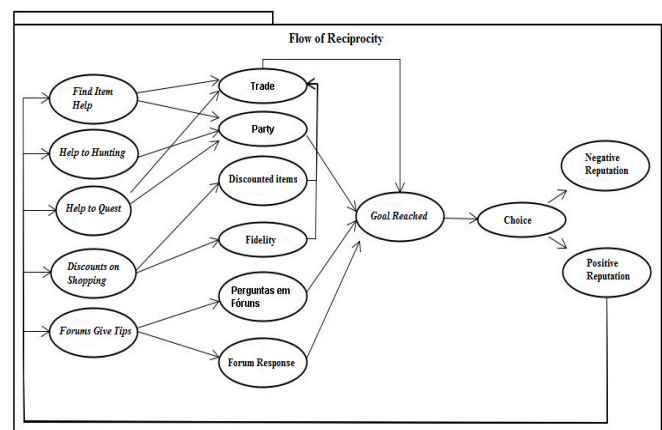


Fig. 1 Flow of Reciprocity.

This flow can be started by any player seeking reciprocity for any of the depicted tasks. Examples of this include different requirements such as *Find Item Help*, *Help*, *Help and Hunting Quest*. As a more focused example, should help mean the assistance in finding an item that another player already has, such item can be transferred through the use of the *Trade* tool. In other circumstances a party could be formed to look for that item, as well as in a set of other different circumstances. Additionally, a party grants its members with the ability to share the money and experience points that the game provides as reward for their activities.

As for the *Discounts on Shopping* circumstance, it relates to those cases when a player employs the reciprocity principle to attain another player loyalty, or to purchase a large number of objects being negotiated with other player. Once the involved players reach an agreement the *Trade* tool is used to transfer the goods.

The *Forums Give Tips* situation occurs when players accesses the virtual platform environment, and perform their questions or searches. After achieving their goals, the researchers approve the responses of other members, thus,

¹ Mission or purpose connected with RPG

² A technical term of RPG applied for hunting in group or to creating a task force.

facilitating future searches and motivating other players to improve their reputations.

By using all tools embodied in this principle, the player arrives at the *Goal Reached* circumstance. As the name suggests, this situation corresponds to the player achieving the intend goal and thus being granted with a choice. To take the passive instance of the principle (in that, repaying the received aid and creating a cyclical movement of the Reciprocity), or to ignore the act of returning the received aid, and thus, breaking the principle cycle. In opting for the last choice, the player is aware of the penalties that may be applied to him/her, which were presented in section 3.1.

As mentioned during the introduction, this paper employs a Petri Net to model the decision-making process that the human player must perform during their gameplay and the different outcomes that may arise from these decisions. The Petri Net built from the Reciprocity principles discussed in this paper is shown in Figure 2, in which depicts the model proposed here, including its states, transitions and the set of guided arcs.

The formal definition of this Petri Net assumes an initial marking m_1 and supports a cyclic movement of its network that is broken only in those circumstances where, the active Reciprocity player opts to not return the aid that was shared with him/her. In addition, the Petri Net modeled contains several final states that are used to identify the amount of people that completed its cycle, as well as to identify the amount of people that did not complete the network's cycle. The states and variables of this network are:

- Variable m_1 – *Start of Reciprocity*: this state addresses when a player uses the reciprocity to get something that desires, by requesting the *Requesting Support* transition. A player can only proceed when that request is available;
- Variable m_2 – *Requested Available*: the state where the player that starts the reciprocity (the initial player) waits for the availability of another player at the same time that it checks for the availability of another player. In case there is no available player, the transition *Supporter Unavailable* is triggered. Otherwise, the *Requesting Support* transition is triggered again;
- Variable m_3 – *Await for Support Request*: this state occurs when the active player of the Reciprocity is choosing what desires to ask to the player of the passive persuasion. In this state there are redundant paths within the Petri Net, as it was developed to model parallel, concurrent, asynchronous and non-deterministic systems. This fact is justified by the Petri Net having being modeled with human activities. Thus, choosing which route to follow depends solely of the active player, who may choose any of the following options: *Buy Item*, *Request Help* or *Ask in Forum*;
- Variable m_5 – *Wait for Discount*: here, the active player takes advantage of discount in items due to various

factors, such as being an active customer, buying a large amount of an item and so on. The passive player will ensure the sale of the product by the exchange of favors. Triggers the *Discount in Item* transition;

- Variable m_4 – *Awaits the Order*: the passive player can only grant the discount if the item is effectively requested. In the event that it does not, the *Item Purchase Unrequested* transition is triggered. Otherwise, the item continues to the *Discount in Item* transition, in which the amount for the item is negotiated;
- Variable m_8 – *True to Purchase*: This occurs when the order value is set, thus creating a reliable purchase. With this, the process proceeds either to *Trade* or to *Purchase Rejected*;
- Variable m_{11} – *Requesting for Negative Reputation*: this state can be said to be one of the final states within the network. This condition occurs when the active player of Reciprocity does not want to proceed with the purchase, thereby creating a bond with unreliable connotations. In this case, the player breaks the cycle of reciprocity and is penalized with the loss of points from its reputation. A situation that is not desirable but that, due the circumstances, is possible;
- Variable m_9 – *Await for Available Item*: as the name implies, it is related to the availability of an item by a passive player who may negotiate it even if he/she does not currently have it. In this scenario, the *Unavailable Item* transition is triggered and the state persists until the seller comes in possession of such an item as so to sell it. At this moment, the *Request Trade* transition is triggered;
- Variable m_{10} – *Trade*: is the state in which the actual sale of an item occurs. Once the said item is available and all its negotiation is set, the *Approve Trade* transition is triggered, in which the item and amount of value involved are checked;
- Variable m_{12} – *Purchase Accomplished*: is the state in which the purchase is concluded and is responsible for triggering the *Reputation Score* transition;
- Variable m_{13} – *Reputation Score by Sale*: this is the final state for analyzing the amount of sale accomplished by the use of this principle, which also allows for enlarging a seller's reputation in the occurrence of future sales;
- Variable m_{14} – *Reputation Score by Purchase*: this state is similar to the previous one; however, its focus rests on the buyer;
- Variable m_{25} – *Reciprocity Goal Achieved*: as the name says, reciprocity does not only occur due to a cycle (albeit this would be the ideal circumstance). In fact it can occur simply by someone, be it the seller or anyone providing the needed assistance, answering to a request at the forums, thus, employing of a Reciprocity that may or not be returned. A characteristic that is due to the work being presented here applying the Principles of Persuasion on its model. That said, next comes the

³ MMORPG tool that players use to sell or exchange goods.

- Activating Reciprocity* transitions, which approaches the choice of the active player in repay the aid or not;
- Variable *m26* – *Awaits the Choice of a Requester*: this state awaits a player's action within either the *Chooses to Not Repay* or *Chooses to Repay* transitions;
 - Variable *m27* - *Negative Reputation for the Requester*: it is a final state of the network that occurs when the active player chooses not to return the Reciprocity and thus, acquires a score with negative impact on its reputation;
 - Variable *m28* - *Reputation for the Requester*: at the *Chooses to Repay* state two parallel routs that may be taken, one of which, takes to the *Reputation for the Requester*. At this state the active player is assigned with a positive score on its reputation, which favors him/her at future activations of the Persuasion. The other route takes to the *Awaits Completion of Reciprocity's Cycle* state that is shown next;
 - Variable *m29* - *Awaits Completion of Reciprocity's Cycle*: this is a stated that merely waits for its own activation, the one responsible for this being either the passive or active player. Once the state is activated it triggers the *Completion of Reciprocity's Cycle* transition;
 - Variable *m30* – *Awaits beginning of Reciprocity*: it is a stated that indicates when the Reciprocity process will start (*Reciprocity Start*). It is at this moment that the network effectively starts, triggering both the *m1* and *m2* states;
 - Variable *m6* – *Awaiting for Help*: this state occurs when the active player chooses the *Request Help* transition and may trigger the *Request Party* transition if there exists a player that intends to help him/her;
 - Variable *m15* – *Await for Available Party*: this state occurs just as the *m4* state. However, it differs from that due to its need to assert whether or not a *Party* aid is available. If it is not, the *Party Unavailable* transition is set. Otherwise, it triggers the *Request Party* transition;
 - Variable *m16* - *Party*: this state occurs when members that intent to aid group together and use of the homonymous *Party* tool. Depending on their conducts, the *Aiding in Progress* or the *Party Rejected* transitions might be triggered, the last, indicating the disbanding of the group, due to a lack of commitment in providing aid that might be on either their or the even on the player's part;
 - Variable *m17* - *Negative Reputation for the Requested*: in case the group or the passive player asks for the disbanding of the *Party*, the reputation of one or of several of the involved may receive a negative score as a penalty;
 - Variable *m18* - *Aid Provided*: this is the end of the aid process and occurs when the group's goal is achieved, triggering the *Reputation Score* transition;
 - Variable *m19* - *Reputation Score by Aid*: similar to the *m13* state but the score in this case is set in reason of a previously provided assistance;
 - Variable *m20* - *Reputation Score for the Assisted*: a state similar to the *m14* one, though the score here is set due to a received aid. Next to this, the previously presented *m25* state is triggered, this continuing the network;
 - Variable *m7* – *Waiting for a Reply*: it is the other path within the network that is triggered when the active player requests the *Ask in Forum* transition, after which, it awaits at this state until a passive player answers it. After a given answer, the active player may or not trigger *Assert Answer*. In case there is no answer, the *No Given Answers* transition is triggered;
 - Variable *m21* - *Waiting for a Question*: occurs when passive players are waiting for a question to answer. In case of no question, the *No Given Questions* state is triggered. However, if a question is made and answered the active player is imbued with the task of triggering the *Assert Answer* transition (as stated above);
 - Variable *m22* – *Tip Provided*: this is a stated that follows the assertion of an answer at the *Assert Answer* state. Next, it triggers the *Reputation Score* transition;
 - Variable *m23* - *Reputation Scored by Tip*: similar to *m13*. Nevertheless, the largest reputations occur here due to an active participation at the forum in providing someone with requested information;
 - Variable *m24* - *Reputation Scored by Question*: a state similar to *m14* that carries on the act of attribute a value to someone's reputation due to asking a question. In parallel to this, the *m25* and thus, all the network keeps moving.
- Aside from the list of states and variables above, there is another variable that is important to a Petri Net model, which is the weight function responsible for the launching (or not) of the network.
- The weight function is given by the strategy of each player, being that each of them, probably, has a distinct number of strategies. Some of the equations provided by The Game Theory were used to develop this strategy. A better understanding of these equations requires a brief overview of some of the Game Theory concepts.

2) Game Theory

Game Theory is a mathematical theory designed to model the phenomena observed when two or more “decision agents” interact. The theory provides a language for the discretion of conscious decision-making processes and the objectives involving more than one individual [5] [6].

Therefore, the application of the principles of this theory to the model proposed in this paper aims to study the choices of optimal decisions under conditions of conflict, precisely, when one person wants to activate the Principles of Reciprocity. For this purpose, the basic game element being considered here is the set of involved players, each of whom has his/her own set of strategies. Additionally, when a player chooses one of his/her strategies, a circumstance or profile is created in the space containing all possible situations (profiles). It must also

be noted that each player has interests or at least preferences focused on different game situations. Mathematically, this ensures that each player has a utility function responsible to assign a real number (the gain of the player) to every game situation [15].

Particularly, the game has the following basic elements: a finite set of players that is given by $G = \{g_1, g_2, \dots, g_n\}$, where each $g_i \in G$ player has a finite set of options written as $S_i = \{s_{i1}, s_{i2}, \dots, s_{im}\}$, which are known as the pure strategy of the player denoted by $g_i (m_i \geq 2)$. Additionally, a $s = (s_{1j_1}, s_{2j_2}, \dots, s_{nj_n})$ vector that has s_{ij_i} as a pure strategy for the $g_i \in G$ player is named a profile of pure strategies. The set of all pure strategies' profiles are a Cartesian product [15] that corresponds to the equation shown in (1) and is known the

game's pure strategies' space. For each player corresponding to a $g_i \in G$ value there is a utility function (which is shown in (2)) and that links the $u_i(s)$ gain of the $g_i \in G$ player to each $s \in S$ profile of pure strategy [15].

$$S = \prod_{i=1}^n S_i = S_1 \times S_2 \times \dots \times S_N,$$

$$u_i : \begin{array}{l} S \rightarrow R \\ s \mapsto u_j(s) \end{array}$$

The two functions above enable a player to choose best strategy to apply the Reciprocity Principle and trigger it at the appropriate moment of the game.

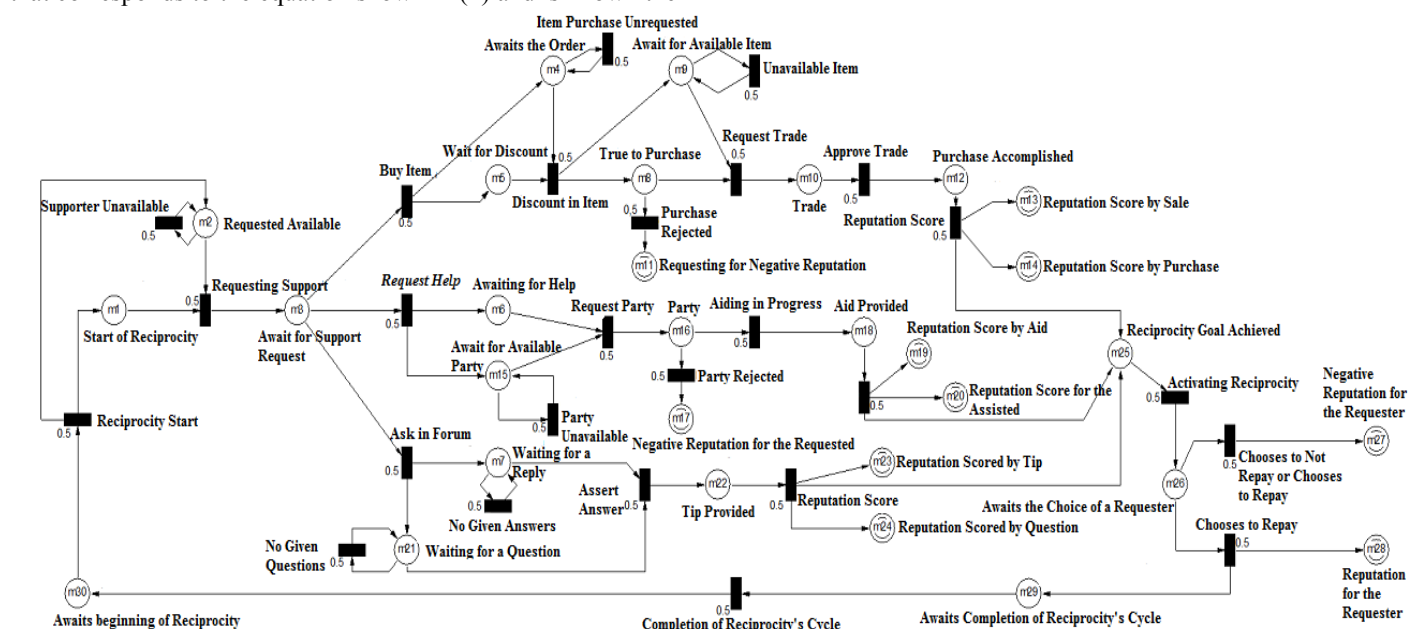


Fig. 2 Reciprocity in Petri Net.

V. CONCLUSIONS

In a videogame perspective, the use of the Reciprocity Principle is an underexplored subject and for this reason, few people are aware of its importance to a game's decision-making process. This fact is reflected by the apparent inexistence of models for decision-that use the reciprocity principle, or any of the other principles of the Theory of Persuasion, and became even clearer along the development of this paper as it confirmed that the use of this theory in videogames is, until this point, very incipient.

Additionally, this paper's research also confirms that the implementation of the Theory of Persuasion as tool for decision-making in MMORPGs' environments can change the way that players deal with information (knowledge) due the fact that, they will employ this theory to create their own best strategies and to improve their relationship with each other..

It must also be noted that, much can be done to improve the work performed here (as there is still much work to do). Moreover, the inexistence of a current commercial interest in developing such environments to aid the educational process or any other area of knowledge makes this initiative an academic project that may never come to fruition.

However such a reality might be changed at the moment that the individuals least aware to the benefits brought by the Reciprocity Principle and the other Principles of Persuasion became clear of the players' needs and are encouraged to develop new strategies for obtaining knowledge, as well as share their knowledge with other players, thus making the MMORPG environment an educational partner.

In this sense, this paper pays attention to the real benefits that the Reciprocity Principle may bring for the development of a decision-making environment, and demonstrates its advantages by using of an actual MMORPG environment to create a model that meet the real needs of players.

Thus, it is believed that by applying to MMORPG environments decision-making systems that combine the principle and theory presented along this paper, such systems will act accordingly with the authors' proposed Reciprocity model, supporting this type of games due to their ability to allow players to better build their knowledge. In that, the reciprocity principle will enhance the decision-making systems due to its capacity to transform the decisions taken upon conditions of uncertainty to the ensuring scenario of the certainty conditions.

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