

# “WHERE IS MY MIND”- THE EVOLUTION OF NPCS IN ONLINE WORLDS

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Abstract: Online worlds are complex places, where we have to know some of the rules of play to engage in the interaction. These worlds are both inhabited by human players and artificial agents called “non player characters” (NPCs). This is an article about how online worlds can contain a new level of interaction using more humanlike NPCs. We propose a new way to describe social interaction in online worlds, where NPCs are modelled to incorporate some of the traits that are more common to man. We also propose a way of analysing current NPCs and a way to create more humanlike NPCs that can contribute to a more unpredictable gaming experience, which seems to be the most promising aspect in the development of online worlds.

## 1 INTRODUCTION

Online games and online worlds have evolved from the textual worlds of the 70s and 80s known as Multi user dungeons (MUDs) into graphically rich worlds that immerse players in these games for long periods of time. Richard Bartle presents five ages of online worlds in “Designing virtual worlds”[Bartle, 2003] and there is reason to believe that we are on the threshold of a sixth age with the games that are most popular today. As an example of a highly popular game world we can use World of Warcraft which has over 12 million active subscriptions monthly. In “Designing virtual worlds” a detailed picture is given of what have been the key ingredients in the evolution of online worlds. Some of the most important aspects this far have been the development on highly detailed graphics and the possibility for people to connect their computer to the internet, but what will happen from now? Edward Castronova claims, “*Of all the technological frontiers in world-building, artificial intelligence (AI) holds the most promise of change*” (Castronova 2006, p. 93) and this view is shared by Bartle: “*From the point of view of world design, AI promises great thing. If virtual worlds could be populated by intelligent NPCs, all manner of doors would open*” (Bartle 2003, p. 616). If we are to believe Castronova and Bartle one possible direction for the evolution of

online worlds is through smarter Non Player Characters.

It is a fact that online worlds, digital worlds, or online games (depending on what we prefer to call them) are popular and have many active players, where World of Warcraft is just one example of their success. It is hard to provide proof for what is the one reason for these games to be as popular, but intuitively social aspects is probably the one most important reason. Humans like to solve problems together, compete or just hang around. And that is the beauty of online worlds; they provide a space with possibilities not present in everyday life.

Our assumption is that the social aspects of online games can be modelled into these worlds in a far more complex ways than we see today. NPCs are the focus of our research, and this is a proposal for how we could create a new dynamic in online worlds.

## 2 CURRENT STATUS OF NPCS

If you spend enough time in an online world, you will start to see patterns. You will understand what kind of game mechanics is important and what affect it will have on your characters development or your game-play. You will sooner or later understand what your possibilities are and what the limitations are.

You will most certainly start to find common traits in many quests or missions that you get involved in and that the computer generated entities; usually called NPCs (Non Player Characters) in the game are not that complex or smart. They will start acting in a predictable way and you will find yourself anticipating much of their behaviour even before they act.

There are typically two different kinds of NPCs in online worlds and the following sections give a further description of friendly and hostile NPCs respectively.

## 2.1 Friendly NPCs

There are many NPCs that assist the player in MMOGs. Some of them are vendors where players can buy equipment or repair items. Others distribute quests for the player, where the quests most of the time involve killing hostile NPCs and collecting items that are essential in completing the quest. All these NPCs have predetermined ways of interacting with players and they are reduced to the function that they are programmed to facilitate. They typically have a scripted dialogue that follow a storyline for different quests that are tailored to fit players of a certain level.

A structural problem in most online worlds is that they are designed to have special places where players are meant to “socialize”. Most players will sooner or later go to a city in these games where the interaction between players is dense, and where NPCs provide different services. Our point here is that friendly NPCs could potentially have a more dynamic role in MMOGs than being vendors or quest givers.

## 2.2 Hostile NPCs (Mobs)

In most games, hostile NPCs are typically different kind of monsters that are either part of a quest or part of the wilderness outside of the city walls. There are both villages where many NPCs of the same type reside, to single NPCs that roam a certain area. When a player is on a quest that involves exploring a cave full of hostile NPCs the difference between encouraging instrumental play or trying to make every such quest a true adventure lies in how the NPCs behave. As mentioned above, most NPCs are fairly static and the ones that display some level of dynamic behaviour will not change their behaviour over time. The most dynamic NPCs will run for help if their “health” reaches a certain percentage of its maximum health, something that

could be explained as some type of “crisis response”. Unfortunately NPCs that runs off to get help do so randomly without even trying to find a potential helping hand.

The limited dynamic and knowledge of NPCs contributes to there always being a possibility for players to easily find a strategy in order to maximize their gain and minimize the cost of killing hostile NPCs. If hostile NPCs could refine their tactics through cooperation and change their behaviour in response to players’ strategies, they would become harder to predict. Depending on preferences there is reason to believe that even the “achievers” from Bartle’s “Player categorisation” (Bartle 2003), would find NPCs with dynamic and unpredictable behaviour a much more interesting counterpart since it would demand skill and dynamic strategies to succeed in killing them.

One important consideration is what do we gain by introducing complex NPCs? Is it just a matter of computational considerations that has influenced game developers to hold back on the complexity of NPCs? Or is it the case that NPCs just have to be “smart enough” to create an illusion of being entities that we need certain strategies to outsmart?

## 2.3 NPCs as Agents

This article will focus on what we believe can be a solution on how to make NPCs more dynamic and unpredictable, also providing a possibility for a deeper interaction between players and NPCs, but in order to create a different kind of NPCs we need a way of measuring their present state.

We have chosen to look at NPCs as agents; with a possibility to model interaction between NPCs in what closely resembles Normative Multi Agent Systems (NorMAS). One question that potentially could pose a problem at this stage is: why the analogy between NPCs and Agents? We strongly believe that if we look at NPCs as social agents in these worlds, we will have the possibility to tailor their behaviour after the same principles that we could use to describe player behaviour. If we treat NPCs and players alike, we introduce a framework to understand players at the same time that we can cater to their needs as players when it comes to the interaction with NPCs. We do not offer any proof or further arguments that this is the only way to look at NPCs but in order to create social NPCs we need to create a possibility for them to adapt to the population of players they are supposed to interact with.

### 3 THEORIES ON HUMAN DECISION MAKING

Given that the behaviour repertoire of NPCs is limited to just a few different types of almost automatic reactions, we propose to have a look at theories about human behaviour. Partly to see in what way we can make NPCs behave more "humanlike" and partly to get a feeling for the important concepts involved.

Many competing theories on human behaviour exist in (amongst others) psychology such as theories about human needs, motivational processes, social comparison theory, social learning theory, theory of reasoned action, etc. Most of these theories address a subset of all possible human behaviour and situations in which this behaviour occurs. A meta-model can be used to unite a collection of these theories into one framework. An example of such meta-model is the Consumat approach (Jager 2000, Janssen and Jger 2000). The Consumat model combines in an elegant way many of the leading psychological theories on human behaviour<sup>1</sup> and categorizes them into a 2\*2 matrix based on the level of need satisfaction (LNS) and behavioural control (BC) on the one hand, and certainty, type of needs, and cultural perspective (CP) on the other hand. Concerning the amount of certainty perceived by the agent, it is either confident in its decision making (and thus adopting an individual based perspective) or uncertain (thus turning towards others for guidance). If the agent has a high need for behavioural control and a high level of need satisfaction it reduces the amount of processing needed (using automated reactions) while a level on both results in a need for cognitive processing. This gives four general strategies humans follow, namely repetition, deliberation, imitation and social comparison (see table 1).

The Consumat model offers NPC developers the opportunity to create a common framework of concepts to create NPC behaviour and also a solution for the problem on how to switch between different behaviour modes. However, since it is a meta-model based on psychological and social psychological theories, it does not address social aspects of behaviour in the way social sciences do. If we really want to have NPC that behave as human

<sup>1</sup> These theories include amongst others Maslows theory on human needs, Festingers theory of social comparison, Pavlov and Skinner operant conditioning theories, Banduras social learning theory, and decision theories from Simon and Ajzen amongst others

Table 1: The Consumat model (adapted from (Jager 2000)).

	Automated reactions (high LNS, high BC)	Reasoned (re)actions (low LNS, low BC)
Individual determined behaviour (certainty, personal needs, private individualist CP)	REPETITION Classical and operant conditioning theory	DELIBERATION Decision and choice theory, theory of reasoned / planned behaviour (attitude and perceived control)
Socially determined behaviour (uncertainty, social needs, egalitarian CP)	IMITATION Social learning theory, theory of normative conduct	SOCIAL COMPARISON Social comparison theory, relative deprivation theory, theory of reasoned /planned behaviour (social norm)

like as possible, we need to include a social theory perspective.

### 4 THEORIES ON SOCIAL BEHAVIOUR

As in the behavioural sciences, theories are abundant in the social sciences. Even here a meta-model can be of help to structure our search. Carley and Newell (1994) have created a matrix on social behaviour to understand and explain the sociability and complexity of agents and to illustrate the differences between different agents based on a variety of (mainly) sociological theories. Their goal is to develop a "Model social agent" (MSA), or an agent that would be an approximation of a human agent which can be found in the bottom-right corner of the matrix depicted in figure 1.

Compared to a "Model social agent", most NPCs would be limited both in knowledge and processing abilities. If we start to look at the knowledge situation (the x-axis in the matrix) NPCs does not cooperate or communicate with other NPCs. What is central for this situation is that if we remove other agents, that leaves us with the "nonsocial task" situation of figure 1, which is devoid of social content. This severely limits the capabilities of NPCs.

NPCs are a bit harder to locate on the Y-axis. We have to bear in mind that the environment limits the

Processing	Knowledge	increasingly rich situation				
Increasingly limited capabilities	Nonsocial task (NTS)	Multiple Agents (MAS)	Real Interaction (RIS)	Social Structural (SSS)	Social Goals (SGS)	Cultural Historical (CHS)
<b>Omnipotent Agent (OA)</b>	goal directed models of self produces goods uses tools uses language	models of others turn taking exchange theory	face-to-face timing constraints	socially situated class differences	social goals organizational goals	historically situated motivation
<b>Rational Agent (RA)</b>	response acquires information	Learn from others education negotiation	scheduling	social ranking social mobility competition	disillusionment	Social inheritance social cognition
<b>Bounded Rational Agent (BRA)</b>	Satisfying task planning adaption	group making	social planning coercion priority disputes mis-communication	restraints on mobility news networks for information cooperate intelligence	delays gratification moral obligation cooperation altruism	gate keeping diffusion etiquette deviance roles sanctions role emergence develop language role development
<b>Cognitive Agent (CA)</b>	compulsiveness lack of awareness interrupt-ability automatic action	group think	crisis response social interaction	automatic response to status cues	Group conflict	norm maintenance ritual maintenance advertising
<b>Emotional Cognitive Agent (ECA)</b>	habituation variable performance	protesting courting	mob action play rapid emotional responses	campaigning conformity	team player	

Figure 1: Social behaviour matrix (adapted from(Carley and Newell 1994)).

possible actions for an agent, and that the mental model of the agent enables more complex goals. Some of the traits of NPCs are similar to the bounded rational agent, in terms of being rational in their attempts to achieve their goals, and that their attention is limited, making it hard for the agent to process all information in its task environment. But NPCs lack some of the components of the “bounded rational agent”, the “cognitive agent” and the “emotional cognitive agent”. NPCs typically lack a memory function and that would make NPCs a class of its own in the matrix. If we consider some of the most typical scenarios when interacting with NPCs we can distinguish patterns that are similar to the behaviour of state machines, where the NPCs typically behaves accordingly to different kind of stimuli. Most NPCs however could be described with some or the traits common to both the “cognitive agent” and the “bounded rational agent” and this motivates the placement of NPCs in the matrix (see figure 1). This spot coincides with the placement of the Consumat model and the theories behind it.

## 5 STEPS TO TAKE

It is obvious that there are many components that NPCs lack in order to display a higher level of

complexity. Even for simple tasks that NPCs cannot yet perform, a memory function with limited learning abilities would improve their capacity for interaction manifold. In order to enrich the NPCs and thus moving them from Nonsocial task situation in the Carley and Newell matrix, we need a possibility for the agents to know more about their task environment, since this influence the complexity of an agents goals. In order to create a social system of agents we need a model to understand what aspects of interaction we should build into the system. And finally we need a mechanism of trust and norms between agents to make them believable in terms of choosing other agents to cooperate with.

### 5.1 Social Aspects and Reputation

When players interact in online worlds there are certain aspects of their interaction that is easier to observe. One such thing is what kind of sanctions that are being used in order to punish players that break the rules or does not comply with the norms of that particular group. In (Verhagen and Johansson 2009) some of these mechanisms are studied at some depth focusing on monetary loss and ostracism of players that does not comply with the rules.

However much of the interaction in computer games and online worlds revolves around

Processing	Knowledge	increasingly rich situation				
Increasingly limited capabilities	Nonsocial task (NTS)	Multiple Agents (MAS)	Real Interaction (RIS)	Social Structural (SSS)	Social Goals (SGS)	Cultural Historical (CHS)
<b>Omnipotent Agent (OA)</b>	goal directed models of self produces goods uses tools uses language	models of others turn taking exchange theory	face-to-face timing constraints	socially situated class differences	social goals organizational goals	historically situated motivation
<b>Rational Agent (RA)</b>	response acquires information	Learn from others education negotiation	scheduling	social ranking social mobility competition	disillusionment	Social inheritance social cognition
<b>Bounded Rational Agent (BRA)</b>	Satisfying task planning adaption	group making	social planning coercion priority disputes mis-communication	restraints on mobility news networks for information corporate intelligence	delays gratification moral obligation cooperation altruism	gate keeping diffusion etiquette deviance roles sanctions role emergence develop language role development
<b>Cognitive Agent (CA)</b>	compulsiveness lack of awareness interruptibility automatic action	group think	crisis response social interaction	automatic response to status cues	Group conflict	MSA development
<b>Emotional Cognitive Agent (ECA)</b>	habituation variable performance	protesting courting	mob action play rapid emotional responses	campaigning conformity	team player	norm maintenance ritual maintenance advertising

Figure 2: The road to future NPCs.

reputation as a value for players. Reputation in online worlds can be something of great importance when it comes to what groups a player will have access to. As discussed in (Jacobsson and Taylor 2003), a good reputation or knowing a player with a good reputation can be the difference of gaining access to a prestigious guild or being denied membership. We therefore need to look at reputation as a value that is important in order for NPCs and players in their evaluation of which players to cooperate with.

For better understanding of the steps to take (i.e. which models and theories to include in agents) we have projected the future NPC or Model Social NPC in on our version of Carley and Newells matrix (figure 2).

## 6 CONCLUSIONS AND FUTURE WORK

We have described the needs for more intelligent NPCs, analyzed the current behaviour set of NPCs and proposed a framework to make this behaviour set more flexible. After this we have proposed a

matrix to add social behaviour to NPCs in order to create a Model Social NPC.

With the ideas and models suggested above, there is reason to believe that we could create dynamic NPCs mimicking player dynamics and create a totally new experience for players. However what is still missing is a full implementation of all the components we argue would be beneficial for the player experience in Online Worlds for us to know for sure if our ideas are too ambitious or even possible. Implementations of reputation system as mentioned in the Consumat section and even in other systems such as RePage have been successful in terms of introducing trust mechanisms between agents (Sabater et al. 2006) and Normative Multi agent systems have been implemented on a second life server (Savarimuthu et al. under publication) our approach is just slightly more encompassing. But to answer the real question whether or not NPCs coordinated by a social system, norms and trust will create the dynamics we are looking for in computer games is yet to be answered.

Future work will be focused at developing a conceptual model with enough detail that makes it possible to implement the key elements for

improving NPCs. That conceptual model should incorporate the parts of Parsons social system on a meta-level, the reputation mechanisms from the consumat system, a memory function that enables the NPC to remember and learn from previous interactions, models dealing with psychological traits, and we also need to implement a norm typology to complement the trust mechanism so that socially not accepted behaviour between NPCs can be detected and sanctioned. Agents must have means to communicate, alter and recognize norms as discussed (Verhagen and Johansson 2009) for norms to be a communicational tool for agents in the social system.

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