Social believable NPCs: a conceptual model and analysis of current NPC models

Most of the current non-player characters (NPCs), especially in MMOGs, are relatively predictable. They lack social awareness and social based decision making. They may display emotions in their features but their behavior does not reflect the emotions on display. The main problem is their internal model, a relatively small set of behavioral states based on a rational agency model with limited processing capacity.

To enable NPCs to display behavior consistent with our expectations of human player behavior, and to be able to form teams of NPCs as well as hybrid teams consisting of humans and NPCs, the internal NPC model needs to change. Some work on this has been done in the area of computational social simulation and dialogue agents and also in the realm of serious games and game design studies. We propose to combine these relatively separate areas into one agency model, where social, psychological and emotional factors are include to produce more humanlike behavior.

The basic definition of any type of agent includes interaction with the agent’s environment. Usually this is limited to task-related interaction with cooperative agents, negotiation or other communication with competing agents and handling of innate objects. The model of the environment reflects this with representations of physical (or innate) objects as well as agents and their characteristics (such as a model of the agent’s internal state and how this can be influenced by acting or communicating). Missing is usually a model of the social environment (such as status, roles, norms in place etc.). The internal model of the agent is in most agent systems build on a Beliefs-Desires-Intentions (BDI) architecture. Other models may be closer to human cognitive structures. Also, the game worlds that the NPCs inhabit need to be built so that NPCs receive input that they can interpret. NPCs, mobs, avatars and other entities in role-playing game worlds that have, or can be attributed with, agency can be thought of as expressive agents (Eladhari 2009). That is, they have an expressive impact on the world through their actions and behaviors.

In computational social science, one example of a meta-model for choosing between individual (rational) decision making and social-based decision making is the Consumat model (Jager 2000, Janssen and Jager 2000). It combines several psychological and social psychological theories on human behavior in a simple yet realistic model of meta decision making. However, this model lacks social aspects such as social structure, norms, culture, and emotions. In (Marsella et al. 2004) an agent-based model of social interactions and influence is proposed, based on psychological and social psychological concepts, comparable to the ones included in the Consumat model, with a focus on learning how others react on ones behavior, working towards a theory of mind agents can use to model other agents. This model lacks any knowledge related to sociological concepts. It is tested in a serious game–like implementation.

In (Coelho and da Rocha Costa 2009) a model for moral agents, to be used in the context of serious games, is presented. The authors focus on a moral system, partly mapping to norms (namely moral norms), resulting in meta control actions over the behavioral repertoire under consideration of the agent. The proposed model essential acts as a filter after cognition, and with emotions parallel to cognition. This leaves out any automatic reactions that are not based on emotions and also limits the
role of the judgment part to being a filter of actions, whereas norms in a wider meaning can be seen to even produce actions or goals. Finally, the model lacks a clear connection to social theories and social theory meta models.

Another meta-model, based on social science theories and concepts, is developed in (Carley and Newell 1994). The matrix of the concepts could help us understand the positioning of current NPCs and also indicate what needs to be added to develop a game or NPC version of the “model social agent” as proposed in (Johansson and Verhagen, 2011). Both the Consumat the PsychSim model can be integrated into this framework.

More encompassing frameworks proposed recently, with a focus on serious game applications include (Inamura et al. 2010) and (Ball et al. 2010). The SigVerse project described in the (Inamura et al. 2010) can be downloaded and tested. It includes an integration of dynamics, perception, and communication, coming from a robotics simulation background (thus with a strong model of embodiment and interaction with a physical environment). The social interaction part is not very well developed yet. The synthetic teammate project (Ball et al. 2010) is also implemented. Coming from military simulations, the authors use what they call a glass box approach using a cognitive architecture at its core rather than the BDI model used in many agent-based models. It includes interaction with the physical environment but also language comprehension and generation (via chat) as well as dialogue management for the language-based communication. Added to this is a situation modelling component. All components are theoretically grounded in psychological theories and models. However, the amount of team members is small and the task is not very generic, thus enabling believable interaction in a quite narrow domain. The authors state that for more generic tasks, the language parts will become very complex. In the context of MMOGs this may be a crucial problem to solve.

In (Ijaz et al. 2011) an overview is given of the aspects of believability in the context of NPC – human interaction in a Second Life environment. The authors focus on integrating believable conversation, including facial expressions, and gestures and body movements, believable awareness, including awareness of the environment, self, and interaction. They also add a normative layer using the concept of virtual institutions. What is missing however is any NPC (or indeed human) decision making on the social level. The normative layer is seen as independent of the agents and thus not open for dynamics from the agents. In essence, breaking norms is impossible. The paper also describes results from an experimental evaluation of the agents comparable to the experiments in (Eladhari 2009) which would be of use for testing our platform when implemented.

From the analysis of the different models we propose a conceptual model of agency for NPCs that encompasses many of the models described above, with the addition of social dynamics. We also include meta-rules to make the model switch from choosing based on its own experience, to imitation to social dynamics such as discussing group rules. In this way the NPCs can in non-complex situations make fast decisions (using reactions or rational decision making), while in more complex situations the behavior will be less schematic and more humanly natural (including social decision making or even decisions about social positions and norms). This model is used to analyze the behavioral model of a collection of NPCs to determine the characteristics present and absent in current computer games. Future work will include the development and implementation of BPCs that are socially believable and test this believability empirically.
Keywords
NPC models, social agents

BIBLIOGRAPHY


Johansson, M. and Verhagen, H. ““Where is my mind”- the evolution of NPCs in online world”, in: proceedings of International Conference on Agents and Artificial Intelligence (ICAART), Rome, 2011.


1In the context of this article we use the terms NPCs and agents interchangeably.