Towards Generating A Society of Virtual Agents With Believable Emotions

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Abstract

Non-player characters (NPCs) often play a key role in interactive experiences. Traditional research literature attempts to use procedural content generation to model NPCs with individual behaviours that are used to validate the NPC's decisions, creating social networks and interactions over their virtual lives. A Drama Manager is generally used to assign emotions to the virtual characters based on the type of the event they partake in. In this proposal, we aim to present a procedural generation approach that can generate a small population of non-player characters that initially conform to the beliefs and opinions derived from their families. Over time the agents construct self opinions derived from their societal interactions. We attempt to model the emotional rationality associated with the agent forced to change their opinions by the group interactions.

Introduction

Traditional video games, treat NPCs as individual characters, with every character born with a random set of abilities, and personalities that dictate their choices through their virtual lives. Predefined emotions are ascribed to the agent based on the type of interaction it takes part in. For instance, losing a job could cause the agent to feel anger at their co-workers, romantic relationships impute a feeling of love, hope or joy towards one's loved one. Current research has approached the generation of these characters using such individual traits (Mateas and Stern 2003; **?**; **?**), little work has been done in the narrative intelligence to understand how generated NPCs respond to group or societal archetypes and opinions(Zyda et al. 2010; Wang, Huang, and Sun 2014).

Recent efforts have pushed past the entertainment industry, using simulated NPCs to train Human-AI interaction in medical science(Bartoli et al. 2012), leadership training(Riedl and Stern 2006; **?**), military training(Banta et al. 2004), education(VanLehn 1996) and more. Most recently, OpenAIs machine-learning playground, Universe, allows autonomous car companies like Google to train their AI driving agents using open world simulations such as Grand Theft Auto (GTA)(OpenAI 2017). Such open world simulations are preferred by various research groups because it gives them a realistic, detailed world to test their algorithms and training models. Amongst other simulations, GTA gives the researchers access to over 1000 unpredictable pedestrians and animals that the autonomous algorithms take into account while navigating through the space(OpenAI 2017; Review 2016).

This move, using NPCs *beyond games* to affect training of real world applications, in both civilian and military environments, means that it is now more important than ever to understand the behavioural complexities of NPCs when interacting with one another in large societies or communities. We posit that modeling NPC behaviours to account for both nature and nurture, would yield what we term as *"culturally rich NPCs"* that can be utilized for a large variety of purposes. Prior work by this author has dealt with dynamic opinion modeling for a simulation of a society of NPCs with individual opinions that are derived from the NPC's parents, or society through multiple discussions of the subject. This work attempts to ascribe emotional responses to the change in these opinions.

Background

Social simulation is achieved through a collection of NPCs that are reactive and appear intelligent, and motivated(Riedl and Stern 2006; Mateas and Stern 2003). A number of studies consider some social aspects in NPCs. Verhagen et al. hypothesizes how an NPC can be believable and lifelike. Afonso and Prada constructs social relationships between NPCs to enrich their social behaviors. Guimarães, Santos, and Jhala constructs a social architecture model for NPCs. Most of them investigate the relation of a NPC and its society in short timespan. However, little research explores the interaction between NPCs and their cultural history, or how predesigned societal norms would affect the behaviour of generated NPCs.

Group formation has been studied in depth by social scientists, historians, commissions and psychologists. However, within the entertainment and narrative field, generated NPCs do not conform to studied theories, instead acting on individual preferences. However, this is not true for the real world. Simply reading a news article on the Internet allows one to gain a perspective of groups being made or unmade to support various issues. In one article, an author may describe how the *Scottish* voted to remain in the recent

Brexit vote(Brooks 2016), in another we hear of *Whovians* that approve or condone representation of women in Doctor Who(Jowett 2014). Yet another describes how protesters to a particular political argument could be considered *anti-American*. Latour discusses how individuals relating to one group or another is an ongoing process made up of uncertain, fragile, controversial and ever-shifting ties(Latour 2005).

Simulation methods such as that of Wang, Huang, and Sun define how agents could change their opinions based on being surrounded by other agents. However, these methods fail to model the complex relationships between these agents that could lead to these changesgratch2004domain, instead assuming a cellular automata approach to opinion dynamics(Wang, Huang, and Sun 2014; Hegselmann, Krause, and others 2002). In contrast, traditional narrative intelligence deals with individual preferences leading to interesting interactions between characters (Riedl and Stern 2006).

We posit that virtual characters, that are able to interact with one another, while allowing said interaction to affect their reasoning and knowledge of the world could be have an large impact in modeling the believability of these characters in open world narratives and games.

Proposed Approach

The modeling of such rich cultural groups of NPCs with similar or shifting opinions, or history could inform the study of audience modeling and machine enculturation, allowing computers to learn about human values or social norms.

With this project we attempt to model the emotional nuances of the NPCs as they respond to events and changes in their environment. To do this we will first undertake a literature survey, contrasting various computational emotional frameworks with one another for their advantages and shortcoming. Once a framework has been selected, we hope to be able to create a short simulation of the emotions and mood associated with various agents as they undertake choices in the simulated world and interact with one another.

One such emotional framework model under consideration is the EMA model (Gratch and Marsella 2004). The EMA model uses Appraisal Theory to model emotional responses of NPCs to their environment, appraising occuring events, and represent an NPC's individual preferences over outcomes. However, experiments on the model fail to deal with multiagent interaction scenarios, where agents may have conflicting goals and intentions. This proposal intends to study how existing frameworks, such as the EMA model discussed above, deal with more complex social interaction simulation.

Prior work by this author has dealt with dynamic opinion modeling for a simulation of a society of NPCs with individual opinions that are derived from the NPC's parents, or society through multiple discussions and conversations on various subjects. This work builds on the same, and attempts to ascribe emotional responses to the change in these opinions as well as with simple interactions and events in the agent's life. Finally, we hope to be able to model the concept of a mood for the agent, based on the outcome several events that may occur in which the agent participates.

References

Afonso, N., and Prada, R. 2008. Agents that relate: Improving the social believability of non-player characters in role-playing games. In *International Conference on Entertainment Computing*, 34–45. Springer.

Banta, H. G.; Troillet, D. B.; Heffernan, N. T.; Plamondon, B.; and Beal, S. A. 2004. The virtual observer/controller (voc): Automated intelligent coaching in dismounted warrior simulations. Technical report, SONALYSTS INC WATERFORD CT.

Bartoli, G.; Del Bimbo, A.; Faconti, M.; Ferracani, A.; Marini, V.; Pezzatini, D.; Seidenari, L.; and Zilleruelo, F. 2012. Emergency medicine training with gesture driven interactive 3d simulations. In *Proceedings of the 2012 ACM workshop on User experience in e-learning and augmented technologies in education*, 25–30. ACM.

Brooks, L. 2016. Scottish brexit voters pose quandary for independence campaign,. *The Guardian* 7.

Gratch, J., and Marsella, S. 2004. A domain-independent framework for modeling emotion. *Cognitive Systems Research* 5(4):269–306.

Guimarães, M.; Santos, P.; and Jhala, A. 2017. Prom week meets skyrim: Developing a social agent architecture in a commercial game. In *Proceedings of the 16th Conference on Autonomous Agents and MultiAgent Systems*, 1562–1564. International Foundation for Autonomous Agents and Multiagent Systems.

Hegselmann, R.; Krause, U.; et al. 2002. Opinion dynamics and bounded confidence models, analysis, and simulation. *Journal of artificial societies and social simulation* 5(3).

Jowett, L. 2014. The girls who waited? female companions and gender in doctor who. *Critical Studies in Television* 9(1):77–94.

Latour, B. 2005. *Reassembling the social: An introduction to actor-network-theory*. Oxford university press.

Mateas, M., and Stern, A. 2003. Façade: An experiment in building a fully-realized interactive drama. In *Game developers conference*, volume 2.

OpenAI. 2017. Universe.

Review, M. T. 2016. Self driving cars can learn a lot by playing grand theft auto.

Riedl, M. O., and Stern, A. 2006. Believable agents and intelligent scenario direction for social and cultural leadership training. In *Proceedings of the 15th Conference on Behavior Representation in Modeling and Simulation*.

VanLehn, K. 1996. Conceptual and meta learning during coached problem solving. In *Intelligent Tutoring Systems*, 29–47. Springer.

Verhagen, H.; Eladhari, M. P.; Johansson, M.; and McCoy, J. 2013. Social believability in games. In *Advances in Computer Entertainment*. Springer. 649–652.

Wang, S.-W.; Huang, C.-Y.; and Sun, C.-T. 2014. Modeling self-perception agents in an opinion dynamics propagation society. *Simulation* 90(3):238–248.

Zyda, M.; Spraragen, M.; Ranganathan, B.; Arnason, B.; and Landwehr, P. M. 2010. Designing a massively multiplayer online game/research testbed featuring ai-driven npc communities. In *AIIDE*.