Decoding the social capability of NPCs

[Extended Abstract]

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1. INTRODUCTION
Traditionally, the development of the believability of non-player characters (NPCs) in computer games has been focused on either designing the story or on the atomic actions of the NPC, such as path finding and tactics. In the case of story, recent research has been put into how characters map into the overarching narrative (such as Lankoski in [7]) and on what constitutes a character (such as Aarseth in [1]). In the case of atomic actions, there is a strong tradition among artificial intelligence (AI) researchers to describe and solve problems of coordination between agents – as well as overarching frameworks for accomplishing this, such as the AI of the game *F.E.A.R.* described by Orkin in [12].

These studies are in essence trying to solve the problem of believable NPC from two different perspectives. To borrow from Aarseth's variable model described in [1] they are trying to approach the problem of believability from either the *narrative*, meaning anchored in story, or from the *ludic*, meaning anchored in the game as it is performed. Whereas the research dealing with believability in relation narrative primarily focuses on what Aarseth calls "Deep characters", which are fully rounded NPC with seemingly real lives, the research related to ludic believability is largely agnostic to the depth of the NPC. Instead, they focus on the actions taken by the NPCs in order to maintain the believability of the game. In [11] Mateas describes a difference between the goals of the research agendas of researchers working on believable agents and of researchers working on AI. In the prior case, terms like *personality*, *audience perception*, *specificity* and *characters* are central. In the latter case, the central terms are instead *competence*, *objective managment*, *generality* and *realism*. The terms used by Mateas can be related to the different types of immersion presented by Ermi & Mäyrä in [4]; *challenge based immersion*, *imaginative immersion* and *sensory based immersion*. Challenge-based immersion is the sense of immersion that the player derives from the ludic challenge of the game, i.e. being engrossed in the performative aspect of the game. Imaginative immersion is the sense of immersion that the player derives from the storytelling aspects of the game, where a strong narrative and deep characters help make the game world feel alive. Lastly, sensory based immersion is the sense of immersion that the player derives from the audiovisual fidelity of the world, i.e. how realistic it looks and feels. Sensory immersion is of course very important to the overall game experience, but it does not really encompass the behavior of NPCs as much as how they look.

The terms used by Mateas to describe the goals of believable agent research reflect important concepts for imaginative immersion – such as characters having personality and that the narrative must be perceived as believable by the audience. The terms used to describe the goals of AI research are similarly connected to challenge based immersion, where NPC opponents must be competent in order to provide an interesting challenge to the player. Furthermore, NPC behavior must also seem realistic in relation to the challenge they present.

In our research we have found that both narrative (imaginative) and ludic (challenge based) aspects NPCs are fairly well developed – the game designer can create interesting scripted sequences and rely on the NPCs to independently perform simple tasks such as navigating a room or effectively attacking enemies. However, the middle "gray area" where the NPCs need to perform more complex actions in a non-scripted, gameplay, setting often reveals immersion-breaking flaws in their behavior. Simply put, the actions taken are not always believable in context. Instead, the NPC's behavior breaks immersion either by breaking character through irrational action, or by acting in such a way that they pose a lesser challenge to the player, thus breaking the player's feeling of imaginative or challenge based immersion.

Other researchers have touched on this area, notably Lankoski & Björk in [8], Lankoski et al in [9] and Loyall in [10], but there is as of yet a lack of descriptive models of NPC behavior that produce concrete problems to be solved (or ideally, have been solved). We believe that such a contribution could be of great benefit to not only researchers who make prototypes, but also game developers and testers.

2. PREVIOUS RESEARCH

In previous research I, along with Björn Stråat, defined a method for analysing the social capability of NPCs in [14]. This study was, however, a test of the method's viability and only encompassed three games – Skyrim [2], RAGE [5] and L.A. Noire [13]. This study established the foundations for our following research; video analysis of in-game observations. These observations were made by playing through the games like one normally would – i.e. doing some quests or following the main story line but also roaming around the world and exploring. These videos were then analysed in pairs, where the researchers graded their impact on immersion in relation to the values found in our adapted version of the *Carley & Newell fractionation matrix* (C&N matrix) from Carley & Newell's article *The nature of the social agent* [3]. This initial study used a binary classification where true meant that the value had in some way impacted immersion. These situations were also described textually in order to further explain the impact on immersion.

In a follow-up study, [15], we expanded the data material to include 14 games and adapted the methodology slightly. This study used a ternary grading of values, where the values were graded as having positive, neutral or negative impact on immersion – again with the accompanying textual descriptions. In this study we found that not all values in the C&N matrix were applicable to games, and that it lacked a certain amount of descriptive power when it came to NPCs. From this study we also formed a number of anti-heuristics for NPC design, i.e. patterns on how to not design NPCs. These are primarily intended as an evaluation tool for NPCs – a coherent and believable NPC shouldn't exhibit behavior that matches any of the heuristics. A subsequent study aimed at refining the method used in the previous two studies, was performed by me, Magnus Johansson and Harko Verhagen [6]. In this study we replaced the previously used *Carley & Newell fractionation matrix* with a matrix that was more suited for the purpose of analyzing NPCs, called the *Game Agent Matrix* (GAM, see figure 1). This study, due to its exploratory nature, once again utilized a rather limited data set. For historic reasons, as well as a good match to the underlying theory of the work, we found that Skyrim, RAGE and L.A. Noire were once again good candidates for analysis. The study showed us that the GAM gave us results that were easier to comprehend, seemingly without sacrificing the descriptiveness of the C&N matrix. Furthermore we found that the values that the GAM gave us a better overview over how behaviors map to the scripted nature of a situation. In short, we found that most NPCs are very capable of basic action, but flounder when they need to exhibit believable behavior in a non-scripted context (i.e. outside of a cut scene or similar). These results are interesting, but need to be validated further.

3. FUTURE RESEARCH

The immediate plan for future research is a larger study using the GAM, essentially a repeat of the second study we performed (see [15]). This will be done partly to further refine the GAM, but also to see if it really achieves the same level of descriptiveness as the C&N matrix. This will also be used to refine our preliminary findings in regards to how behaviors map to the "scriptedness" of a situation. We expect these results to be quite similar, as they were so in the previous case.

Further on we intend to attempt to remedy the problems found in the middle gray areas (as described in the introduction), and thus tying together the concepts of story and atomic action. Since we know how a story should be performed in order to be believable, and we know how to perform actions in a way that is believable, bridging the gap between these two should be fairly straightforward. In order to do this, we will use the GAM to identify and deconstruct problematic behaviors into atomic actions, and try to address them using a different approach than the currently common, simple, finite state machine approach. This will allow us to identify where the problems with the atomic behavior exist, and to apply fixes in a more directed manner. Similar approaches have been tried by for example Orkin [12], but in rather way that is still very similar to the puppeteering nature of traditional games AI. We instead intend to take the approach that each NPC is responsible for its own behavior, as opposed to being controlled by some sort of overmind.

Lastly, behavior related to the exhibition of in-game culture and society is still very much relegated to the domain of story and deus ex machina. NPCs only exhibit cultural awareness to the extent that this is enforced by the story – for example by playing sound clips or reacting to story-based cues. If the responsibility of upholding the culture and society of the game could be transferred from "overmind" to the NPCs, the process of making the cultural and social cues comprehensible to agents in the world could potentially be simplified since we could utilize existing theories of how we humans process culture. Hypothetically, this could be combined with natural language processing and algorithms for profiling users in order to "mine" the cultural and social contexts from the actions of others in the world, and to present the illusion of the NPCs having "memories" of past events to the player. This could help is prevent very illogical, if slightly amusing, situations, as we encountered in Skyrim after joining the thieves' guild and saving the town from a dragon. Where one guard would be very impressed by the dragon slayer who saved the town, the next one would show mistrust and tell us to not to steal things. This seemed to happen randomly, where guards that had previously greeted us as a hero would see us as a criminal minutes later. The duality of the savior of the town being a member of the thieves' guild was completely incomprehensible to these NPCs. If NPCs were to properly parse the cues it had been given about the player it would have made these situations less illogical and nondeterministic.

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Figure 1: The Game Agent Matrix

	Single Agent	Multiple Agents	Social Structural	Social Goals	Cultural Historical
Act	Goal directed Route following Uses language Uses tools	N/A	N/A	N/A	N/A
React	Adaption Acquires information Crisis response Interruptability Lack of awareness Models of self Rapid emotional response Navigation	Learns from others Models of others	Class difference Mob action Social ranking	Disillusionment	Advertising Institutions Roles
Interact	N/A	Face to face Group making Social interaction Turn taking	Coercion	Clan Wars Cooperation Group conflict Patriotism Power struggles Team player	Etiquette Norm maintenance Sanctions

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