Breaking immersion by creating social unbelievabilty

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Abstract. For the last 20 years, computer games and virtual worlds have made great advances when it comes to audiovisual fidelity. However, this alone is not sufficient to make the games seem believable – the game world must also seem to be alive. In order to accomplish this, the world must be populated by realistic characters who behave in a coherent and varied way. Many game developers seem to realize this, and the capacity of the artificial intelligence controlled non-player characters in the games are often large selling points. However, as pointed out by recent research these opponents do not always exhibit realistic, coherent and varied behaviour. We have examined this phenomenon by analysing a number of games where non-player characters are especially important for the players' enjoyment, and established six anti-heuristics that can be used to identify non-desirable behaviour in non-player characters.

1 Introduction

While many of today's games focus on the aural and visual experience of game play, some researchers have put forward that AI (Artificial Intelligence) may be bring games to a new level. Castronova [5] states that "*of all the technological frontiers in world-building, artificial intelligence (AI) holds the most promise of change*". A similar reasoning is presented by Bartle [1] who writes about the potential of AI-controlled non-player characters (NPCs) in games: "*from the point of view of world design, AI promises great things. If virtual worlds could be populated by intelligent NPCs, all manner of doors would open*". These two quotes both deal with the importance of NPCs in making the world feel alive.

The main factor in making the world feel alive is immersion - which is described by Bartle [1] as "*the sense that a player has of being* in *a virtual world*". If the player cannot immerse himself in the world and forget outside distractions the magic circle of the game, as described by Huizinga [6], collapses and the player's lusory experience is lessened. As such it is important that the NPCs act in such a way that they are seem to be creating a living world. This requires that the NPCs have varied and believable behaviours. If they do not, the player will soon begin to see patterns in how the NPCs act - as explained by Johansson & Verhagen [7]. If the player can see the proverbial clockwork ticking away in the background the player's immersion disappears and the magic circle is dispelled.

It should, however, be noted that some game developers have attempted to introduce more complex behaviours in their games. Famous examples of this include the game *Half-Life* [10] which at the time of launch received praise for the teamwork performed by the enemy NPCs present in the game. This trend was continued in *F.E.A.R* which utilized a goal-oriented architecture to further advance the teamwork capabilities of the NPCs, as explained by Orkin [9]. A more recent example is *Skyrim* [3], where the player's decisions have lasting effects on the world. These games all exhibit fairly complex social behaviours in the teamwork of the NPCs and their interaction with the players, but as Johansson & Verhagen [7] point out one can still see patterns in the behaviour of these NPCs.

However, in order to rectify any problems associated with repetitive behaviour in these NPCs we first need to describe these behaviours and make them explicit. This study aims to identify the types of NPC behaviour that has an adverse effect on the player's sense of immersion.

The next section (2) explains the pedigree of the method used in this article, as well as the preceding studies performed in this area. The changes made to the method in regard to preceding studies is explained in section 3. Section 4 explains how the games included in the study were selected. In section 5 the main work and data collection of this article are presented, followed by the resulting anti-heuristics in section 6 and the conclusions and future work in section 7.

2 Previous work

Johansson & Verhagen [7] used an adapted version of the *Carley & Newell Fractionation Matrix* (C&N matrix) presented by Carley & Newell in [4] to describe the attributes of their suggested architecture for more believable NPCs - the *Model Social Game Agent* (MSGA). Carley & Newell originally combined theories from sociology relating to human behaviour into a matrix to visualize what they call a Model Social Agent (MSA) – an agent with strong, human-like, social behaviour.

In the matrix (our adapted version can be seen in figure 1) the X-axis illustrates Knowledge; i.e. an agent's needed knowledge in relation to an increasingly advanced situation, going from non-social tasks (e.g. cutting wood) where the demand on knowledge is rather low and the agent can act on perfect information, to more refined cultural behaviour and perspective (e.g. upholding norms) where the agent acts on imperfect information. The Y-axis illustrates Processing, where the agent goes from being omniscient/omnipotent (OA, top left) with no need to gather information or reflect on its tasks, to an emotional cognitive agent (ECA, bottom row) who, in theory, lets "*emotions modify and limit the behaviour of the cognitive agent*" [4]. The further down and to the right one looks in the matrix, the more human-like the agent becomes. In total, the matrix contains 74 examples of social behaviour, such as "goal directed" and "crisis response".

A study similar to this one has been undertaken before by Lankoski & Björk [8]. Unfortunately, that study is based on a limited data set (one game) and used design patterns to examine one single NPC. The results of Lankoski & Björk's study are valuable,

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but may be hard to apply by the members of the game development industry who actually implement the NPC AI in games since they are of a rather abstract nature.

In a previous study, described in [11], we used a combination of Johansson & Verhagen's and Carley & Newell's matrices, resulting in a matrix with a total of 80 values, as seen in figure 1. This was a pilot study performed in order to examine the matrix's viability as an evaluation tool for NPC social capability in games.

3 Method

The methodology of this study is derived from our previous study [11] and as such uses our adapted version of the C&N matrix (once again found in figure 1). For the study described in this paper we clearly defined a sentence describing the meaning of each value in the matrix, and then used these definitions[3] when analysing the included games. Similarly to our approach in our previous study, we have taken a "black box" approach to the analysis of NPCs – we simply accepted the behaviour of the NPCs at face value rather than to try to understand what the actually programming was telling the NPC to do, much like a player without knowledge of game development would. The opposite of this would be to take a "glass box" approach and study the working innards of the NPCs. However, the "glass box" approach was discarded since it was considered unfeasible to persuade a large number of game developers to share their proprietary code with us.

The data for this study was collected by recording game play in 14 games (see table 1 below for a list of games) as video, continuing until no new behaviours were exhibited by the NPCs in the game. We observed a wide variety of situations, encompassing all kinds of social behaviour – ranging from street conversations to combat. These videos were then analysed in two stages, separated by 6 weeks and performed by a two researchers per study who strived for consensus. The approach of doing two separate studies, each using multiple researchers, was taken in order to ascertain the validity of the study by applying multiple layers of triangulation. During the analysis process, each scenario encountered in the videos was described in text and evaluated for possible immersion-breaking behaviour according to the values in the C&N matrix. Each value was considered separately for a given scenario.

The intermediate data created in the previous step was then used to determine the most significant values in the C&N matrix, more specifically the values that were violated in at least 5 games during either study. At this stage, a game's violation in regards to a value was only counted once. Hence, if a game violated a certain value seven times it was still only counted once for the purposes of selecting values. The significant values can be seen in table 2.

Lastly, the descriptions of the violations of the significant values were examined in order to find similarities between them. The similarities were then reformulated into a set of heuristics that can be used to evaluate how flawed an NPC is.

4 Included games

The games included in this study can be seen in table 1. These games were selected based on the following criteria:

- AAA-titles, i.e. big-budget studio titles
- The player takes the role of a single character at a time (but may have several helpers)
- Not older than 10 years

These critera were chosen in order to ensure that the games incorporate fairly recent technology, and had the necessary funds to actually put money into the development of the AI controlling NPCs within the game. We decided not to search among lower budget or independent titles, since they are less widespread, and thus, possibly, making any problems found less general. The list of games (see table 1) is a rough estimate on high end titles over the selected time frame, and may therefore not give an accurate estimate of the fidelity of lower end titles. However, the assumption is that problems found in high end titles will also be applicable to lower end titles, whereas the reverse may not be true.

Lastly we chose to limit ourselves to games where the player controls one character at a time, so that the representation of personal interaction would be easily recognizable and as such less prone to misunderstanding.

5 Applying the matrix

The end result of this research was a collection of heuristics, totaling a number of 6, based on an analysis of the 14 games (see table 1). These defined how NPCs should act if they intend to break the player's feeling of immersion, and are as such called "anti-heuristics".

The intended use for our anti-heuristics is reminiscent of the analysis of an NPC done by Lankoski & Björk [8] in Bethesda's role-playing game *Oblivion* [2], where the authors used different patterns to identify weaknesses in NPC behaviour. While Lankoski and Björk used their patterns to describe the *capabilities* of a given NPC, our anti-heuristics are intended to be used in identifying the *failings* of a given NPC. The reason for this reversed use is that it lets the analyst look for things the NPC *does* rather than things it *does not* do.

In doing the analysis of the games we found that certain values in the Carley & Newell fractionation matrix were more commonly occurring than others when the games broke the player's sense of immersion. These were *Adaption*, *Lack of Awareness*, *Models of Others* and *Models of Self*. The specific number of occurrences can be seen in table 2. These values display certain common traits between the situations we encountered in the games, and examples thereof are described in the sections below, along with the definitions we used for each value. While these values are not the only ones that were relevant to our study, they were by far the most commonly occurring.

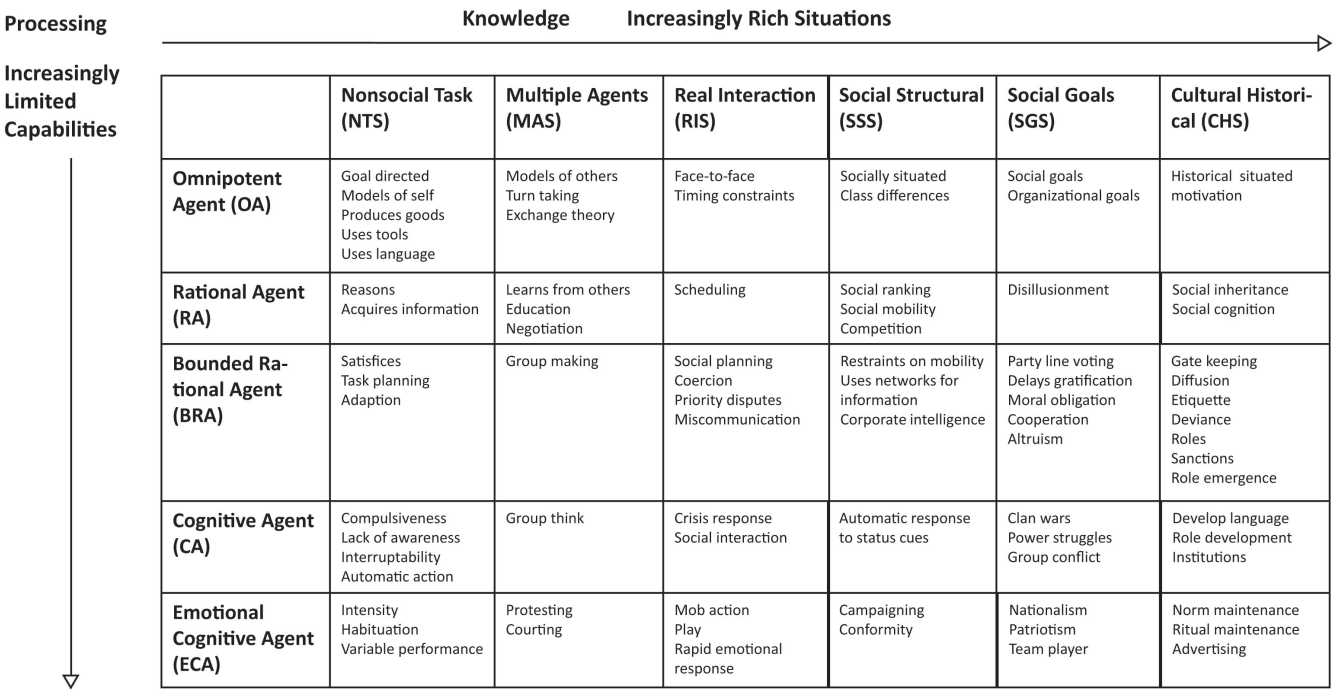
5.1 Adaption

For the purpose of this study we defined Adaption as "Characters adapt their behaviour to the present situation, including interrupting current tasks if the change in situation requires it". In the adapted C&N matrix, Adaption is located in the intersection of *Nonsocial Task* and *Omnipotent Agent*.

The analysis of the material in our data collection gives us two versions of Adaption failure; an entity either fails to adapt to improve its situation or adapts in such a way that its situation gets worse.

We obeserved an example of adapting to a worse situation in LA Noire. In this situation the player is inside a warehouse, engaged in a firefightand using a cupboard as cover. Hiding behind another cover a few meters in front of the player are two NPC gunmen, who take potshots at the player.

[3] These definitions have not been included in this paper since they would take up too much space, but the ones that are relevant to our results are presented as needed.



	Nonsocial Task (NTS)	Multiple Agents (MAS)	Real Interaction (RIS)	Social Structural (SSS)	Social Goals (SGS)	Cultural Historical (CHS)
Omnipotent Agent (OA)	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	Historical situated motivation
Rational Agent (RA)	Reasons Acquires information	Learns from others Education Negotiation	Scheduling	Social ranking Social mobility Competition	Disillusionment	Social inheritance Social cognition
Bounded Rational Agent (BRA)	Satisfices Task planning Adaption	Group making	Social planning Coercion Priority disputes Miscommunication	Restraints on mobility Uses networks for information Corporate intelligence	Party line voting Delays gratification Moral obligation Cooperation Altruism	Gate keeping Diffusion Etiquette Deviance Roles Sanctions Role emergence
Cognitive Agent (CA)	Compulsiveness Lack of awareness Interruptability Automatic action	Group think	Crisis response Social interaction	Automatic response to status cues	Clan wars Power struggles Group conflict	Develop language Role development Institutions
Emotional Cognitive Agent (ECA)	Intensity Habituation Variable performance	Protesting Courting	Mob action Play Rapid emotional response	Campaigning Conformity	Nationalism Patriotism Team player	Norm maintenance Ritual maintenance Advertising

Figure 1: The adapted Carley & Newell Fractionation matrix

Table 1: Games included in the study, sorted by title

Title	Developer	Year	Description
Assassin's Creed: Revelations	Ubisoft	2011	Historical fiction action role playing game
Dragon Age: Origins	Bioware	2009	Fantasy role playing game
Dragon Age 2	Bioware	2011	Fantasy role playing game
Fable 3	Lionhead Studios	2011	Fantasy role playing game
Fallout 3	Bethesda Softworks	2009	Postapocalyptic role playing game
Mass Effect	Bioware	2007	Science fiction action role playing game
Mass Effect 3	Bioware	2012	Science fiction action role playing game
L.A. Noire	Team Bondi/Rock Star Leeds	2011	Modern-day murder mystery game
RAGE	id Software	2011	Postapocalyptic first person shooter
The Elder Scrolls III: Morrowind	Bethesda Softworks	2002	Fantasy role playing game
The Elder Scrolls IV: Oblivion	Bethesda Softworks	2006	Fantasy role playing game
The Elder Scrolls V: Skyrim	Bethesda Softworks	2011	Fantasy role playing game
Vampire, the Masquerade: Bloodlines	Troika Games	2004	Fantasy role playing game
Warhammer 40,000: Space Marine	Relic Entertainment	2011	Science fiction third person shooter

Table 2: Significant values from both rating sessions

Value	Cell in C&N matrix	Study 1	Study 2
Adaption	NTS/BRA	4	9
Lack of Awareness	NTS/CA	6	7
Models of Others	MAS/OA	10	10
Model of Self	NTS/OA	2	8

When the camera is panned around, a third NPC gunman can be seen standing at a flank position, enabling him to shoot the player in the back. Instead of firing his weapon, the gunman runs away, into the player's field of fire and takes cover with his companions.

It can be posited that a person's rationality wavers when in a close quarter fire fight, but it seems very peculiar that a gunman should leave a good flanking position to put himself in a more risky position. The running gunman is a good example of Adaption failure.

5.2 Lack of Awareness

Lack of Awareness was defined as "Characters are unaware of events, not necessarily caused by other characters, happening in their immediate vicinity". In the adapted C&N matrix, Lack of Awareness is located in the intersection of *Nonsocial Task* and *Cognitive Agent*.

There are two sides to lack of awareness, over-awareness and obliviousness. The previous case, over-awareness, is illustrated by a scenario from *Vampire, the Masquerade: Bloodlines*. In this scenario the player walks through a house full of NPC thugs, who ignore him. He then walks out to the back of the house without anyone seeing him and shuts off the power. The thugs in the house are instantly aware of where the player is, that it was he who shut off the power and that they should attack him. Here the thugs show an extraordinary level of awareness - no one saw the player flip the power switch and yet they know that it was the player who shut off the electricity.

The latter case, obliviousness, is illustrated by a number of villagers in *Fable 3*. In this scenario the player is walking around in a village and shooting her pistol at the local NPC villagers, and since Fable 3 has a "safety mode" that can be turned on and off the player is currently unable to harm the villagers and the shots go slightly to the side. However, the villagers do not react in the slightest to the bullets flying around their heads but instead go about their daily business as if nothing had ever happened.

5.3 Models of Others

Models of Others is defined as "Characters are aware of what other entities are doing and where they are located". In the adapted C&N matrix, Adaption is located in the intersection of *Multiple Agents* and *Omnipotent Agent*.

We can exemplify Models of Others with a scenario from Skyrim: Here the player encounters a "fugitive" who hands over an item and tells the player to keep it safe, and that he will kill the player if she tells anyone. Any further interaction with the fugitive is fruitless; he simply repeats his former threats.

As the player follows the fugitive, they come upon a small pond in the forest, where a pair of hostile monster crabs reside. As they approach the pond, a hunter runs up to the player, and the fugitive cries for help and runs away to hide. The hunter engages the player in conversation, asking if she has seen a fugitive nearby, even though the fugitive just ran past the hunter, passing in plain sight no more than a few meters from him. The hunter even formulates his question as "Did you see anyone run past just now?". However, in approaching the player, the hunter is attacked by one of the monster crabs. The hunter questions the player about the fugitive while the crab happily gnaws away on the hunter. After the player finishes the conversation, the hunter dies from the crab attack.

The breaches of Models of Others here is that the hunter fails to observe the fugitive passing by and the monster crab attacking him.

5.4 Model of Self

Model of Self was defined as "Characters are aware that they are being affected by events happening around them". In the adapted C&N matrix, Adaption is located in the intersection of *Nonsocial Task* and *Omnipotent Agent*.

This is a scenario from Oblivion, where the player approaches a lizardman (an anthropomorphic lizard standing on two legs) standing close to the castle moat. By walking into the lizardman, the player is able to nudge him over the edge, into the moat. The lizardman falls in and starts treading water, with his head just over the surface, without complaining. The player jumps into the water and is merrily greeted by the lizardman. This lizardman seems unaware of what the player just did and is seemingly oblivious to his situation.

6 Anti-heuristics

After analysing a number of situations in the aforementioned games, we discovered a number of common weaknesses. These have been aggregated as a number of rules for how to *not* design an NPC. These are not solely based on the examples given above, but rather use a bigger data set. However, the examples above were partly chosen since they show these behaviours very well.

Our anti-heuristics are:

1. Ensure that the NPC always knows everything that is happening in the world. It should be omniscient!
2. Ensure that the NPC is seemingly unaware of things that it should feasibly be aware of.
3. Ensure that the NPC is seemingly unaware of what others are doing that could affect the NPCs, its friends or the environment.
4. Ensure that the NPC is seemingly unaware of actions performed that directly involve or affect it.
5. Ensure that the NPC always reacts in such a way that it makes its present situation worse.
6. Ensure that the NPC, through lack of reaction, never improves its situation.

These anti-heuristics may seem to cover overlapping areas, but that is wholly intentional. The rules are intended to be used together, and as such each individual rule does not contribute a lot of new knowledge. In this case, the total really is more than the sum of its parts.

The astute reader will also notice that they sometimes contradict each other, and this is also an intentional aspect of them. In the case of awareness, there seems to be a certain part of the awareness spectrum that makes a character seem believable.

7 Conclusion and final thoughts

The breaches of immersion that were found were frequent and often very obvious, and they occurred in a wide variety of games (representing roughly ten years of development). Given that some of our findings are seemingly obvious, and were found by simply playing the game, the developers cannot be unaware of these issues. While we understand that there are practical and financial limitations on how much effort can be put into creating believable NPC in games, but we have chosen not to include this consideration in our work. The goal was, as mentioned, to find NPC behaviours that negatively affect immersion, without taking any heed to the underlying system.

However, the issue of cost and commitment of the game developer is interesting. If we can communicate the results of this study to a

game developer, and get a different perspective, we could certainly get material for several interesting reports.

Using this fairly straight forward and simple method we were able to isolate several immersion breaking errors, and while we presented a small set of anti-heuristics this list could easily be expanded using the same method. These anti-heuristics (ours and potential new ones) can then be of use to both researchers and game developers, since they allow for quick identification of potentially immersion-breaking situations.

Unfortunately the method used in this study is not without flaws. The C&N matrix is a rather unwieldy construct, and many of the values are less usable for games; examples of this would be values that imply an insight into the inner workings of the mind of an NPC, such as *Social Cognition*, which conflicts with our "black box" approach to the inner workings of the NPC. Other values that could have been of use were lacking in the matrix, such as the ability to evaluate if the way the NPCs navigate the world was believable. In order to remedy this issue we have begun work on a replacement model based on the C&N matrix, but better adapted to the context of computer games.

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