Mind the gap – Exploring the social capability of non-player characters

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Abstract

Among the most important factors governing enjoyment of computer games is immersion, or the feeling the player has of being in the game world. This feeling allows the player to be transported into the world of the game, where they can experience grand adventures and riveting tales. Many factors contribute to the feeling of immersion, but as with any story-based experience the actors in the story are of the utmost importance. If the actors perform poorly, however, the player's feeling of immersion will be lessened, and the game will become less entertaining. Therefore, the Non-Player Characters (NPCs) inhabiting the game world must act in such a way that they are perceived as believable. Unfortunately, this is not always the case, and NPCs often disrupts the player's feeling of immersion.

The purpose of this research is to describe how we can create NPCs who behave in ways that are conducive to player immersion, and who better portray the story of the game. This is done by identifying the current issues affecting the believability of NPC behavior.

Over the course of the studies described in this thesis, we have developed a method by which problematic behaviors can be identified and described. This was done by studying NPCs in modern games using video recordings, and using an analytical tool to identify the specific factors that affect the believability of their behavior. In the end, we identified a number of such factors that affect the believability of NPCs, chief among them the inability of NPCs to perceive the world. By improving the way in which NPCs perceive the world, and more importantly how players perceive that NPCs perceive the world, we can greatly improve NPC believability.

Acknowledgements

As I finish up this thesis on a very rainy November night, I feel that I should mention some of the people without whom this thesis would never have happened. Unfortunately I won't be able to thank everyone who deserves it, and I deeply apologize to anyone who feels forgotten and left out. Now, on to the list of well-deserved thanks.

My mother, father and sister. Thank you for keeping me grounded, believing in me and supporting me through this process.

My supervisors, Harko Verhagen and Lars Asker. Thank you for not only providing me with sage advice, but also for your invaluable help in getting me to actually *write* this thesis. Without you, it would definitely not exist.

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My bachelor students from the spring of 2012, for helping me gather some of the data used in this thesis.

Lastly, my friends for sticking around, being there, and trying to lure me to social outings and whatnot, despite me becoming a thesis hermit. Thank you for putting up with my never-ending tales of thesis woe and my many excuses. I promise I'll stop being a hermit now that the thesis is done.

This thesis is dedicated to my mother, father and sister. Thank you for your support and patience.

List of Papers

The following papers, referred to in the text by their Roman numerals, are included in this thesis.

PAPER I: **A method for comparing NPC social ability**
Warpefelt, H., Stråat, B. (2012). *Proceedings of the 5th Annual International Conference on Computer Games and Allied Technology (CGAT 2012)*, pp. 58–63.

PAPER II: **Breaking immersion by creating social unbelievabilty**
Warpefelt, H., Stråat, B. (2013). *AISB 2013 Convention. Social Coordination: Principles, Artefacts and Theories (SOCIAL.PATH)*.

PAPER III: **Analyzing the social dynamics of non-player characters**
Johansson, M., Stråat, B., Warpefelt, H., Verhagen, H. (2013). *Presented at the 44th International Simulation and Gaming Association conference (ISAGA 2013). Publication fortcoming*.

PAPER IV: **Analyzing the believability of game character behavior using the Game Agent Matrix**
Warpefelt, H., Johansson, M., Verhagen, H. (2013). *Proceedings of the sixth bi-annual conference of the Digital Games Research Association: Defragging Game Studies (DiGRA 2013)*.

Author's contribution

This thesis presents two main contributions: a description of the main issues facing NPC believability, and a method for discovering these issues. These contributions have both been published in multi-author papers, and consequently my contributions may be less clear. The group in which this work was performed has a strong collaborative element, and therefore identifying the specific contributions for each author of each article is difficult.

The embryo of the method was first spawned in Paper I (Warpefelt and Stråat, 2012), where a prototypical version of the method is described. The method was later refined in Paper II (Warpefelt and Stråat, 2013), where the analysis part of the method was changed in order to remedy methodological problems inherent in the analysis part of the method used in Paper I. Paper II also provided us with the initial version of the results presented in Chapter 5 of this thesis. These papers were jointly developed by my co-author and I, and as such my contributions constitute of 50% of the final content and findings.

In Paper III (Johansson et al., 2013) we introduced a new analysis tool, which was jointly developed over a number of round-table discussions with all the authors of the article. The data collection part of Paper III was performed by three of the authors, and the latter analysis involved all four. Consequently, it is hard to judge the exact percentage of the contribution I have provided, but it is somewhere just over 25%.

In Paper IV (Warpefelt et al., 2013) we expanded the study performed in Paper III, using a bigger data set. This provided us with some changes to the analysis model used in the study, but also a thorough descriptions of the shortcomings of NPC behavior. Again, the data collection was performed by two of three researchers, and the analysis involved all three. Therefore, my contribution to this paper should be somewhere around 35 to 40%.

It should be noted that these percentages do not include time spent writing the different papers, but rather only the time spent performing the actual research.

Contents

Acronyms

AAA Triple-A

AI Artificial Intelligence

BA Believable Agent

C&N matrix Carley & Newell fractionation matrix

FPS First-Person Shooter

GAM Game Agent Model

HL *Half-Life*

ME *Mass Effect*

ME3 *Mass Effect 3*

MMORPG Massively Multiplayer Online Role-Playing Game

NPC Non-Player Character

RPG Role-Playing Game

RTS Real-Time Strategy

SF Science Fiction

WC3 *Warcraft III: Reign of Chaos*

WoW *World of Warcraft*

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1. Introduction

Computer games are designed to entertain, and in order to do so they must capture the player's attention and whisk them away to a fantasy world. If this transition to the fantasy world is to take place, the players must be able to lose themselves in the game – they must be *immersed* in the game. Non-Player Characters (NPCs) play a large role in maintaining the player's sense of immersion and help make the game enjoyable (Bartle, 2004; Castronova, 2005).

Unfortunately, NPC behavior sometimes affects immersion in a negative manner, most often by not acting in accordance with their character and the story, or by failing to provide a sufficient challenge the player (Warpefelt et al., 2013). While there is previous research focused on either the narrative of the game, for example (Lankoski et al., 2011) and (Lankoski, 2004), or the challenge posed to the player, for example (Orkin, 2006), these studies approach the problem of NPC believability from very different directions, and they do not present a common notion of what constitutes *believable* NPC behavior.

Because of this inherent divide in the research approaches it is difficult to determine when a NPC is performing believable behavior. The lack of descriptions of what constitutes believable behavior affects the ability of game developers to create NPCs who can act in context that are not rigidly controlled by pre-defined story elements, which in turn leads to the negative impact on immersion described above (Warpefelt et al., 2013; Warpefelt and Stråat, 2013).

1.1 Purpose, goals and research question

The purpose of this study is to pave the way for creating NPCs that behave in more believable ways. In order to do this, we need to establish the current state of NPC believability, and in what ways they fail to uphold the player's sense of immersion. To be able to identify these issues we need to establish a method by which we can describe these behaviors and describe in what ways they affect believability. This method will then be used to elucidate the answer to the research question: *In what ways does NPC behavior fail to uphold believability?*

1.2 Results and contributions

The results of the thesis are twofold. First, a method is established for analysis of NPCs in games, which is introduced in the following section (1.3) and described in detail in Chapter 4. Secondly, this thesis provides a description of the current state of NPC behavior that affects believability. This is described in detail in Chapter 5.

The method developed over the course of this thesis work fulfills the second goal, i.e. the way in which we describe the problems mentioned above. This method has been utilized and refined across four studies (Johansson et al., 2013; Warpefelt et al., 2013; Warpefelt and Stråat, 2012, 2013). In essence, this methods presents a way to rapidly, and with minimal training, identify issues with NPC behavior.

The results of applying this method is also the second result of this study, as well as the fulfillment of the first goal. By using the method to analyze a number of games (as described in Chapter 4) we can describe how NPCs behavior affects believability, in which situations this happens and what the main problems with the behaviors are.

1.3 Method overview

This thesis uses an empirical method consisting of analysis of recordings of NPC behavior in computer games. This method has been used in all of the included studies (Johansson et al., 2013; Warpefelt et al., 2013; Warpefelt and Stråat, 2012, 2013), with a few alterations as the method has evolved with the publications. The studies included in this thesis use a common method for data collection and, to some extent, analysis. Although some parts of the analysis have changed, these changes were the product of evolutionary steps – a sharpening of Occam's razor, if you will. The exact natures of these changes are described in Chapter 4.

Data collection for these studies was performed by playing through a number of games and recording social situations that occurred as videos. These situations were gathered by casting a wide net when doing recordings, and accordingly there are several hours of recordings from most games in the study. The recordings run the gamut of social situations, ranging from combat to life in a small town.

Analysis was done by viewing the recordings of the situations appearing in the videos and searching for problematic social behavior on the part of the NPCs. Behavior was recorded in two ways; as a relation to a value in one of our evaluation models (see Figures C.1 and 4.1) and as a thick description of the situations and the problematic behavior.

1.4 Reading this thesis

This thesis consists of six chapters. This introduction makes up Chapter 1. Chapter 2 describes what constitutes the believability of NPCs, and Chapter 3 describes how NPC believability has previously been dealt with in games research. Chapter 4 describes the method applied in this thesis, which has been used to produce the results described in Chapter 5. The implications of the results described in these chapters will be discussed in Chapter 6, along with recommendations for future research.

Since the thesis contains involved descriptions of a number of different computer games and characters, I have included to appendices describing the nature of NPCs (Appendix A), and the games used in this thesis (Appendix B). These are intended to give brief introductions to the reader who is not familiar with the subjects, and to serve as a refresher course for those who are already familiar with the material in question. The further two appendices describe additional information relevant to the method.

2. The believability of NPCs

NPCs play a major role in upholding the immersion of computer games, where their behavior creates immersive stories and exciting challenges. However, when it fails to do so this instead achieves the opposite effect – and the sense of immersion suffers. In order to uphold the player's feeling of immersion, the NPCs need to act in ways that are interpreted by the player as believable and coherent. Furthermore, they must also align with the player's expectations of the character. (Desurvire et al., 2004; Loyall, 1997)

For example, a dog barking at the mailman would be considered believable behavior, whereas the mailman barking at the dog would not. Conversely a talking human would appear completely normal, whereas a talking dog would not. It should be noted that both of these are dependent on context. A human character who is portrayed as insane may very well strengthen immersion by barking, and we may accept a talking dog if the virtual world signals that this is something that exists in this particular universe. Loyall (1997) uses Disney's character Dumbo as an example of this type of alignment; in the real world a talking elephant who flies with his ears would be sure to make us question our sanity, whereas in the Dumbo universe it is completely normal and accepted as a given part of the portrayed world.

2.1 Immersion and believability

Immersion is, as described by Bartle (2004), the feeling the player has of losing themselves in the game world. It is essentially the effect caused by *suspension of disbelief* (Coleridge, 1817), whereby the player will accept the game world as a believable and, to some extent, real world. As the term implies, this acceptance is reached when the player abandons some of their preconceived notions (however well grounded they may be) and accepts that the game world works differently from the "real" world.

Although a game takes place in a separate world of sorts (Huizinga, 1955), players do still carry some tropes with them into the world of the game. These manifest themselves as expectation that the game world will present certain cultural notions held by the player. As exemplified by Loyall (1997), talking animals may be believable simply because that trope is present in the cultural

situation that the player carries into the world. Waggoner (2009) calls this *simulacratude*, meaning the characteristic of being a *simulacrum*, i.e. an object that is an instantiation of a concept that exists in the cultural context (Baudrillard, 1994). This contrasts to something being a pure copy of something that exists in the real world. Waggoner exemplifies this with Disneyland's *Main Street USA*, which is a simulacrum of the American view of a main street in a town. The simulacratude of an object is what imbues it with believability, and is a central part in immersion. By providing the tropes that players are familiar with, game developers can evoke certain responses from the players, and give signals about what the player should expect from the game and its world. This gives the players hints that they should suspend their sense of disbelief, as it were, and accept that the game world runs on different rules from those of the real world – essentially the game world should signal what the player *should think* is believable.

2.2 Contextual believability

Although believability can be strengthened by connecting the behavior of NPCs with familiar tropes, these tropes must also fit into the greater narrative of the game world. This means that the narrative must contextualize the tropes, and indicate to the player how they fit together, and how they fit into the narrative of the game world. Therefore, believability is dependent on the justification of tropes given by the narrative and is thus highly contextual.

An example of well-implemented contextual believability for NPCs is the Marines in Valve's *Half-Life* (HL) (see Appendix B.9). In the game, they act and sound as the player would expect of soldiers in an action movie, thus adding to the player's experience through believable behavior and by providing the trappings associated with the relevant tropes. Another example is the village blacksmith Griswold from Blizzard's *Diablo* (see Appendix B.2), who with his faux-Scottish accent, bald head and bulky build evokes the image of the traditional, down-to-earth village blacksmith of so many fantasy worlds. Although Griswold does not move around at all during the game, he is still believable because of his social behavior and persona, and this contributes to the player's sense of immersion.

As seen in these examples, NPCs take on many different roles in games. Some provide challenges to the player, others act as allies or bystanders. According to Bartle (2004) those found in virtual worlds are as follows:

- *Buy, sell and make stuff.*
- *Provide services.*

- *Guard places.*
- *Get killed for loot.*
- *Dispense quests (or clues of other NPCs' quests).*
- *Supply background information (history, lore, cultural attitudes).*
- *Do stuff for players*
- *Make the place look busy*

– (Bartle, 2004)

These roles require different attributes and capabilities from the NPCs portraying them, and the players expect different things from the NPCs on the basis of their perceived roles. For example, an NPC who dispenses quests will likely need to convey a fair amount of information to the player, such as the objectives of the quest. Conversely, an NPC guarding something could feasibly be believable by simply being able to perform dismissive behavior, such as saying *"I'm busy. Go away."* in a number of different ways (in addition to seemingly protecting something). In other words, the NPCs must successfully display the intended simulacratude. Furthermore, the genre of the game may also impact on what is considered believable. In a science fiction game we may expect to see soldiers who use advanced maneuver warfare tactics, making use of cover and covering fire. In a fantasy game we may instead expect soldiers to charge forward to attack the player with mêlée weapons. Both of these are in keeping with the simulacratude of the world, and help uphold immersion based on the expected behavior of the agents in the given context. This contextuality is not only related to the audiovisual presentation of the NPCs within the game but also to the role that the NPCs play within the game.

These examples all describe how NPCs can behave in ways that strengthen the player's feeling of immersion. Immersion, however, is not a monolithic construct but rather a composite of many factors. As can be deduced from the examples above, NPCs can affect many different types of immersion in many ways through different kinds of behavior.

2.3 Types of immersion

Ermi and Mäyrä (2005) broke down immersion into three categories, outlined in the sections below. These represent different ways in which the player can be lulled into accepting the world of the game's more fantastic quirks which are related to different aspects of the game. These are:

- Imaginative immersion

- Challenge-based immersion
- Sensory-based immersion

These are described in the sections below (2.3.1-2.3.3). Each type of immersion ties into a different aspect of simulacratude – the appearance of Griswold (see 2.3 above) signals simulacratude from the aspect of sensory-based immersion, and the tactical acument of the Marines in HL signals simulacratude from the aspect of challenge-based immersion. Both of these attributes contribute to imaginative immersion in that they strengthen the narrative of the game.

2.3.1 Imaginative immersion

Imaginative immersion is the part of immersion that is related to the story, characters and world of the game. Adams (2010) calls this type of immersion *narrative immersion*. Adams's name for this type of immersion is apt, since it captures the central point of the immersion type. In order to maintain imaginative immersion, the characters and the world must weave an interesting story – a narrative – that engrosses the player and presents a solid facade. This type of immersion is lessened when the facade starts to crack, for example through characters behaving in ways contrary to their nature or if the story has plot holes. As can be expected, this type of immersion is not applicable for games that lack narrative, such as Tetris.

2.3.2 Challenge-based immersion

Challenge-based immersion is the type of immersion derived from the challenge and the difficulty of the game. This type of immersion is upheld when the difficulty of the game is high enough to challenge the player, but not as high as to make the player feel despondent. In essence, the level of difficulty must let the player immerse themselves by entering "the zone", where the challenge becomes engrossing. This type of immersion is prevalent in almost all games, but is the main operative immersion factor in games such as Tetris and Chess. However, it is also present in more complex games – for example in the aforementioned Marines from HL or similar enemies in id Software's *RAGE* (see appendix B.12).

Adams (2010) presents two types of immersion that tie into the concept of challenge-based immersion, *tactical* and *strategic* immersion, which represent different types of immersion related to performative challenges. Tactical immersion is the part of challenge-based immersion that requires quick reactions and decisions – essentially the operative principle for immersion in Tetris. Strategic immersion, on the other hand, is the type of challenge-based immersion that arises from the challenge of planning the overall strategy to win the

game. This is primarily featured in Chess, and arises from the challenge of tying together moves in order to outwit the opponent, while not being outwitted in turn.

2.3.3 Sensory-based immersion

Sensory-based immersion is the type of immersion related to the audiovisual fidelity of the game. This type of immersion entrances the player with a beautiful world and rich music. It rarely stands on its own, however – instead it acts as a vehicle for the other two immersion types. It provides the graphical clarity which allows the player can discern the story and world, and what is to be done in a certain challenge. Examples of pure sensory-based immersion includes music for dramatic effect and realistic nature such as the vistas of Bethesda's *Skyrim* (2011) or music that sets the mood of a scene. It should be noted that this type of immersion does not necessitate high-fidelity graphics. Instead, the selection of a low-fidelity approach signals a different collection of tropes, evoking a feeling of "retro" game play.

2.4 Immersion and genres

As mentioned in Section 2.2, player expectations of NPC behavior may vary depending on the genre to which the virtual world or game belongs. In a Role-Playing Game (RPG) the player may very well expect to encounter most (if not all) of the NPC roles described by Bartle (2004), whereas in a First-Person Shooter (FPS) the player would most likely not expect to encounter many NPCs who buy, sell and make stuff, but almost exclusively NPCs who get killed (often for loot). Unfortunately, genres are rarely as clear cut in practice as they are in theory. Games often take on characteristics of multiple genres, and are often not easily placed into one genre Dahlskog et al. (2009).

Because of this cross-pollination of genres it is futile to reason about expectations of NPCs in relation to genres. Instead, we should discuss how believable NPCs are in relation to the tropes they portray depending on their role in the game (such as guarding places or being killed for loot) and the context in which the NPCs must portray this role. The genre concept should instead be seen as collections of expected tropes and characteristics – which in turn signals what the players can expect from the NPCs in terms of behavior and appearance. Because of this, a player's expectations of a guard in a fantasy RPG will differ from those of an NPC providing plot exposition in a science-fiction FPS.

3. The two approaches to NPC studies

As outlined in the previous chapter, NPCs need to portray believable behavior that is in line with the expectations of the players and the context in which the behavior is performed. However, the current approaches to achieving believability seem to fall broadly into two different camps. Although both of these approaches aim to produce believable, interesting and challenging opponents, there is seemingly little cooperation between the fields.

3.1 The two worlds of NPC studies

In order to differentiate the approaches to NPC research described in this chapter, I have decided to divide them into *narrative* and *ludic* approaches, inspired by the work of Aarseth (2012). In Aarseth's research, these are described as the two antipodes on a scale that defines the characteristics of the narrative of the game. In the narrative case, the game is essentially a static story shown to the player, with little interaction and a tightly plotted narrative. Conversely, the ludic case is a game that has no perceptible narrative and where the characters are simply robots who perform a certain task.

Extrapolating from the reasoning in Chapter 2, and as stated by Aarseth, the different types of narrative impose different requirements and expectations on the NPCs found in them. Aarseth describes three types of NPCs[1]; *deep characters*, *shallow characters*, and *bots*. Deep characters are described as as characters who change and develop as the story progresses. Shallow characters are often like Griswold from Diablo, a character with very little actual character development and a fairly one-dimensional personality (see 2.3 and Appendix B.2). Bots are characters who have no identities, but rather are just anonymous entities. The Marines from Half-Life (see 2.3 and Appendix B.9) are an example of the bot type of NPC.

Similarly, Mateas (1999) outlines two basic approaches to describing agents in games. The approaches are divided into Believable Agents (BAs) and Artifi-

[1]Aarseth uses the term "agent". For the purposes of this thesis, these terms are interchangeable.

cial Intelligence (AI). Mateas describes BAs as being primarily focused on personality, audience perception, specificity and characters whereas AI is focused on competence, objective measurement, generality and realism. In essence, BAs exhibit characteristics closely related to those of imaginative immersion (see 2.3.1), wherein the perception of the characters and their personality is of foremost concern. Conversely, AI exhibits characteristics closely related to challenge-based immersion (see 2.3.2), wherein competence and objective measures of difficulty are central to maintaining the correct level of challenge.

Using the NPCs typologies of Aarseth and Mateas we can further identify the narrative and ludic approaches. The narrative approach most strongly relates to Aarseth's deep characters, whereas Mateas's AI and Aarseth's bot types both strongly relate to the ludic approach. This leaves us with Aarseth's shallow characters and Mateas's BAs. These types of NPCs indicate that the approaches used by Aarseth and Mateas are fundamentally different. Yet they are not completely incompatible, as will be explained in the subsequent sections.

3.2 The narrative approach

Work into characters related to the narrative approach has primarily focused on designing more believable characters (Aarseth, 2012; Lankoski, 2004; Lankoski and Björk, 2007; Lankoski et al., 2011; Loyall, 1997). This research has, as previously mentioned, focused on producing characters that weave into the narrative of the game and who have the appearance of being real, living, people.

Research into this field is mostly concerned with what constitutes a character, and how they should act within the context of the story. Very little thought is given to behavior being adaptable, but rather the assumption seems to be that the behavior can and will be rigidly controlled. Albeit deep characters portray character development and deep personalities, this does not mean that their behavior is greatly adaptable in-game. One example of a deep character is Arthas from Blizzard's *Warcraft* franchise (see Appendix B.14-B.15). Arthas has a deep, complex and meaningful character arc – but his behavior is highly scripted in all the games in which he appears. The player cannot cause Arthas to choose a different path in the story, and they can only advance the story as it has been written.

Examples of research in this field include that by Aarseth (2012), which discusses the narrative structure, character types and how characters are used to weave a narrative. Another example is the NPC types presented by Bartle (2004) as mentioned in Section 2.2. Bartle describes how NPCs fit into the design of virtual worlds, and how they can be made to both lessen and strengthen

the players' sense of immersion. Lankoski and Björk (2007) presented a number of design patterns for believable behavior in NPCs, which were derived from the game *Oblivion* (see Appendix B.5). The patterns, along with others developed later, were later used by Lankoski et al. (2011) to describe an agent architecture designed using these patterns.

3.3 The ludic approach

Work on characters related to the ludic approach has primarily focused on providing the player with worthy and competent opponents (Orkin, 2006) or allies (Tremblay and Verbrugge, 2013). These NPCs rarely allow for deep and meaningful interaction, but are rather treated as bots (Aarseth, 2012). The focus of this research is to create NPCs who provide the player with a sufficiently challenging experience, rather than a deep and engrossing narrative.

Examples of research in the field include the aforementioned article by Orkin (2006), in which the author describes how the enemy AI in the FPS *F.E.A.R.* was implemented. The system described was put in place in order to provide the player with the feeling of a challenging enemy, while still keeping difficulty in check. In a similar case, Tremblay and Verbrugge (2013) created a system where an NPC acted as a companion to the player and assisted them in order to preserve the level of challenge and to maintain immersion.

3.4 The gap

NPC believability is still very divided into separate traditions. Although there has been some research into the area, such as that by Mateas (1999) and Loyall (1997), there is still much to be done in order to bridge the gap between these traditions. Unfortunately, both of these traditions are still rather insular. There is little inter-tradition cooperation, and each of the traditions is exploring a separate part of believability. This is akin to the fractionation of the AI field described by Laird and VanLent (2001), where researchers focus on smaller and smaller domains at the expense of the full picture. Unfortunately, this reduction of concerns to very small areas carries with it problems in that it is impossible to build a complete picture of something from its component parts. Instead, a more holistic approach is required.

As seen in Section 3.1 above, there is a gap in the way researchers reason about NPCs. Mateas and Aarseth have both introduced typologies, but they essentially measure different things. Aarseth focuses on how well the NPCs weave into the narrative, and Mateas on how well they are able to perform the actions required for believability. These aspects are both of utmost importance

to achieve believability, but neither can stand alone. Future NPC research must take both into account. As detailed in Chapter 2, the believability of NPC behavior is very much dependent on context, and as such this context must be provided by some means. However, the contextualization itself is virtually useless if the behaviors performed within it do not match the expectations of the player. The approach here must be that the narrative provides the context, whereas the ludic provides the actual actions to be performed in that context. By combining these two factors and leaving the nitty-gritty details of specific behaviors to the NPCs, game developers can take the believability of NPCs to a new level of freedom, and allow for more flexible stories in games.

4. Methodology

In order to bridge the gap described in Chapter 3, we need to describe the middle ground between the two worlds of narrative and ludic NPC research. This Chapter presents a method for describing this gap between research traditions, along with the evolution of the method. In doing this, we identify and describe situations where NPC behavior is not perceived as believable, and thus fails to uphold player immersion.

4.1 Method

The method used for this thesis consists of observations made in games, coupled with analysis using one of two different tools. The observations were made by playing a number of games (Table 4.1) as a player would and as the game developer intended – i.e. following the main quest line as well as exploring potential side missions and the world, while not consciously trying to exploit any bugs or other weaknesses in game mechanics. Since the games studied have differed slightly in terms of freedom of exploration, the amount of free roaming done varies between them. Given the difference in games, most[1] of the data collection was performed until theoretical saturation was reached – i.e. when no new results were identified using the evaluation tools. The observations were recorded as videos, and archived for further study. Furthermore, situations that were found to affect immersion and believability were also given thick descriptions, in which the behavior of the NPCs was described and contextualized.

Although the same general method has been used throughout all the papers included in this thesis, the two older studies use a different analysis tool and included an add-on processing step at the end of the common method. The changes made are described in detail in Section 4.2.

The approach of performing observations in games was chosen in part as

[1]The data collection was in part performed with the assistance of students. The following games had data collected with a three hour time limit: *The Elder Scrolls III: Morrowind, Vampire: The Masquerade: Bloodlines, Mass Effect, Dragon Age: Origins*. In practice, the occurrence of new results ended long before this limit was reached.

a measure of convenience – studying NPCs in-game is more a accessible approach than studying the code that drives them. The latter case requires cooperation with game developers, and given that many developers consider their NPC AI architecture to be proprietary and a trade secret, this approach was not likely to yield a sufficient volume of results to actually give an answer any of the questions posed. Furthermore, attempting to find the part that makes an NPC believable by looking at its code is in itself a fool's errand akin to that of dissecting something with the purpose of finding the part that contains the soul.

By performing observations instead, we can find where the behavior of the NPCs do not facilitate behavior *in context*. As explained in Chapter 2, believability is contextual. Therefore, the research method used must take into account the context in which the behavior is performed. This philosophy is similar to that of anthropology, where observations are made within the context. This type of interpretive research gives deep insights into the meaning of the behavior, albeit at the cost of generalizability. However, given the interpretive nature of the research this should be expected. The use of anthropological methods to study denizens of games is not unprecedented, having previously been used by among others Boellstorff (2008). However, the anthropological approach is not fully applicable in a situation where the studied party is not a conscious entity – as is the case with NPCs. Because of this, the studies included in this thesis have used the techniques associated with the participant observations often found in anthropological studies without actually becoming true participant observation. Although the researcher doing data collection was participating, the NPCs were simply reacting to stimuli rather than consciously altering their behavior to interact with the player.

The analysis of the gathered data used particular tool (see figures C.1 and 4.1) to elicit the results from the data corpus. This does not, however, imply that the data were collected as structure observations. Rather, the observations were performed in free-form format, and later analyzed with a structured tool. This allows for the collection of a wide variety of scenarios from the different games, while maintaining rigour through a more stringent analysis.

The original tool selected for the research, the Carley & Newell fractionation matrix (C&N matrix) created by Carley and Newell (1994), was selected since it had previously been used as an evaluation tool in prior research (Johansson and Verhagen, 2011). Furthermore, its intended purpose is the analysis of agents, and it is derived from a large number of sociological theories. All in all, the C&N matrix was very well anchored in previous research. However, use of the C&N matrix proved problematic in practice since it was primarily focused on modelling the *internal* state of agents. Therefore a new model was developed, the Game Agent Model (GAM). The GAM was introduced in Pa-

per III (Johansson et al., 2013), and was designed to remedy some of the major shortcomings of the C&N matrix, as described in 4.2.

The respective matrices allows the user of the method to identify specific behaviors that may be problematic, and "hotspots" where problematic, non-believable, behaviors are clustered. Combined with the thick descriptions provided of the situations, these hotspots can used to identify specific issues that impact the believability of NPC behavior, and thus the players' sense of immersion.

4.2 Method evolution

The initial study described in Paper I (Warpefelt and Stråat, 2012) used an adapted version of the C&N matrix, as seen in Figure C.1, and simple Euclidean distance to compare the difference between two games. However, this method suffers from severe limitations in that it creates such a level of abstraction that much of the interesting information is lost in the comparison. Because of this issue the analysis method was redeveloped in later research.

In the following, expanded, study described in Paper II (Warpefelt and Stråat, 2013) we discarded the comparison methodology in favor of expanding the thick descriptions given for each situations. These were later abstracted to produce the anti-heuristics mentioned in Section 1.2. In performing the study, we discovered that the C&N matrix was less than optimal for the intended use. This led us to develop a new model for use in the evaluation part of the method. The GAM, seen in Figure 4.1, was intended to alleviate the shortcomings of the C&N matrix. In essence, many of the values in the C&N matrix were not used since they dealt with the *internal* workings of the NPC, which were not always *externally* visible. Given that our observations were of visible behavior, the superfluous values in the C&N matrix only served to make analysis harder. Furthermore, some aspects of NPCs were not accounted for by the C&N matrix, such as pathfinding in the game world.

The GAM was constructed by breaking down the C&N matrix and reconstructing it with rearranged columns and replaced agent names. Most columns from the C&N matrix were retained, with the exception of the *Real Interaction* (RIS) column. The values in this column that were transplanted to the GAM were mostly of a time sensitive nature, and since the context of a game is never not time sensitive, they were instead integrated into other columns.

Instead of focusing purely on the internal capacity of the NPC, the GAM focuses on the external behaviors of the NPCs. The new agent types are:

- *Acting agents*, who do not modify their behavior to accommodate changes in social context, but rather are unaware of the social context. An act-

ing agent simply performs the actions that it has been designed to perform, and is largely unaware of other agents. If it takes other agents into account, it regards them as obstacles to be navigated around in the "physical" world of the game – they are essentially considered to be mobile rocks. Consequently, the acting agents is incapable of performing behaviors that involve more than one agent.

- *Reacting agents*, who can perceive changes in the environment as well as the social context. The reacting agent has a basic understanding of social contexts, and is aware of the existence of other agents and that they are agents. However, it does not model their internal state.

- *Interacting agents*, who are aware of other agents and model their internal state.

It should be noted that each increasing level of agent capability also encompasses the capabilities of lower-level agents. Therefore, reacting agents encompass all the capabilities of acting agents, in addition to the attributes described above.[2]

The cells in the GAM were populated by analyzing which values had had a significant impact on the results presented in Paper II (Warpefelt and Stråat, 2013). That study was performed in two iterations, and values that had occurred more than once in either iteration and at least once in the other were deemed to have a significant impact.

4.3 Method critique

The most obvious criticism that can be leveled against this research is its subjectivity. However, this is an inherent feature of interpretive, qualitative, research and as such need not be a problem. Rather, the problems described in this thesis are of such a nature that the context, and thus subjectivity, in which they are encountered are of the utmost importance.

In examining this as interpretive research, the fairly low number of involved researchers may pose a problem. The data corpus, however, has been analyzed a number of times with each tool. The C&N matrix was used in (Warpefelt and Stråat, 2012) and (Warpefelt and Stråat, 2013), and the GAM was used in (Johansson et al., 2013) and (Warpefelt et al., 2013). Although researcher triangulation should ideally be stronger, this is compensated by the use of data triangulation. Furthermore, much of the data was collected by students who performed similar studies as part of their bachelor degree.

[2] In case of a conflict in capabilities, the more advanced behavior takes precedence.

	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 Awareness Models of self Rapid emotional response Navigation	Learns from others Models of others Turn taking	Class difference Mob action Social ranking	Disillusionment	Advertising Institutions Roles
Interact	N/A	Face to face Group making Social interaction Memory of previous interactions	Coercion	Clan Wars Cooperation Group conflict Patriotism Power struggles Team player	Etiquette Norm maintenance Sanctions

Figure 4.1: The Game Agent Model

Although this thesis describes a number of problems, these should not be considered to be all-encompassing or generally true. Some of the problems we have found may have been the result of over-analysis and as such may matter less in a non-research scenario. This will be explored further in future research, as will be described in Chapter 6. Furthermore, there is a risk of *under-analysis* inherent in this type of study. As is discussed in Chapter 2, the believability of NPC behavior is largely dependent on previous experience with tropes and genres – players simply expect certain tropes to appear in for example a fantasy game. This may prove problematic in reaching broad believability, if it is desirable to include those who are not already familiar with the tropes. In essence, it is possible that games teach to players to connect certain tropes, which may lead to researchers simply disregarding non-believable behavior on the basis that it is in line with the trope. This does not, however, necessarily invalidate the results of the study. Again, as described in Chapter 2, this process of trope signaling is vital in order to convey the "genre" and narrative limitations of the game. If games do indeed teach their players, the lack of knowledge about tropes will at worst be a passing problem. Furthermore, researcher triangulation should mitigate this shortcoming until the transfer of tropes can be completed.

In a similar case to the one mentioned above, games may in some cases (Hopson, 2001) take on aspects of the operant conditioning box developed by Skinner (1938). Essentially, the game conditions players to perform certain actions, such as picking up power-ups to gain advantages or using cover to protect themselves from enemy weapons. This causes players to fall into certain habits, and may impact the in-game situations in which players put their avatars. Because of this, some elements of game play may be missed if they are too novel or different. Assuming that the players are already conditioned may cause problems if inexperienced players stumble upon weaknesses in NPCs behavior that more experienced players would not be as likely to encounter. Researcher triangulation should also mitigate this problem to some extent, but it is difficult to avoid completely without using less experienced players as data collectors. Unfortunately, the less experienced players would rapidly gain experience. This approach is also problematic in that it is essentially the same thing as trying to provoke errors in the game – which is counter to the approach of playing the game as it was intended, as per the intended method.

4.4 Research ethics

The work described in the thesis fortunately has only a few ethical problems to consider. Chief among these is the fact that our critique of the games may influence game sales. This is, however, mitigated by the fact that these games

are all two or more years old, and as such the games have already sold the majority of the potential copies. In fact, some of them may be difficult to find in stores. Furthermore, the critique we leverage against the games most likely has equal or lesser impact than the reviews that accompany every game release. Therefore, any potential influence that this research may have on sales should be of little consequence.

As for the studies performed, there are two things that must be considered: the fact that students gathered some of the video data, and that there may be involuntary participants in the video data. The first case is a small consideration in that it may influence the quality of the gathered data. However, the method is fairly easy to use and the students were given instructions on how to use the method. Furthermore, the students used the same data for their own bachelor theses, and therefore were not treated as free labor. The second case would have been problematic if we were studying games where there were other players, in that they could potentially be involuntarily included in the data. Since this thesis uses exclusively single player games, this is not an issue in the cases examined in the thesis. A similar consideration exists for the behavior of the students in the data gathered by students. However, the student data were used with their explicit permission.

4.5 Included games

The 14 games included in the data set for this thesis can be seen in Table 4.1. These were selected based on different criteria for different articles. For papers II (Warpefelt and Stråat, 2013) and IV (Warpefelt et al., 2013) these were that the games should not be older than 10 years, be a big-budget, Triple-A (AAA) studio title and be a game where the player controls one character at a time. These criteria enabled us to identify games that were recent and had a budget big enough to ensure that the AI aspect of the game was not discarded. Furthermore, the similarity in social interaction between the game and the real world was not interrupted. For Paper III the games were selected on the basis of their affinity with the different forms of immersion (see Chapter 2).

It should be noted that some games have more advanced NPCs than most AAA titles, such as *Prom Week* (McCoy et al., 2011) and *Façade* (Mateas and Stern, 2003). These are generally not widely played, however, and therefore do not affect the vast majority of gamers. By targeting AAA games we can instead identify issues that affect most gamers, rather than a small group.

Table 4.1: Games included in the different studies, sorted by title

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

5. NPC behavior

This Chapter explores how the behavior of NPCs affects player immersion with regard to the narrative and ludic aspects of the games. The effects will be described using the GAM (see page 41), by discussing the relevant issues related to each column. Since the behavioral complexity described by the GAM is cumulative, the description will start with the rightmost column, *Cultural Historical*, and progress left to the *Single Agent* column – thus starting with the most complex behaviors and moving downwards on the complexity scale. As seen in Figure 4.1, the columns in the GAM are as follows from right to left:

- Cultural Historical
- Social Goals
- Social Structural
- Multiple Agents
- Single Agent

This thesis uses two important terms to discuss the effect of NPCs on immersion – *value* and *behavior*. Values refer to the terms in the GAM, such as *Advertising* or *Models of Others*, and are the measuring points by which we describe how NPCs influence immersion and believability. The second term, behavior, refers to the actions performed by the NPCs, such as running, talking or using tools. These behaviors map to values in the GAM, as can be seen in the value descriptions found in Appendix D.

Note that some aspects of NPC behavior are rigidly controlled by the game designer – such as cut scenes made with the game's engine. These are outside the scope of the research presented here, and the focus is instead on the behaviors performed by NPCs in the game world as the player plays the game. These behaviors are performed live, in context and in reaction to the actions of other entities, such as the player or other NPCs. This delimitation was chosen in order to separate heavily designed scenarios (i.e. cut scenes) where the player is essentially viewing a short film from those where the player can interact

with the NPCs. The latter type requires a more flexible NPC design, since the behavior of the players is inherently unpredictable.

These short films sometimes spill over into the game world, for example where the player retains control of their character but the NPCs give an exposition. We see this type of strictly controlled behavior as belonging to the *predefined narrative* of the game, and count it as part of the in-game behavior. This is opposed to what we term *emergent narrative*, which is the part of the narrative that arises from the spontaneous interaction between entities in the world, be they NPCs or players.

5.1 Cultural Historical

Behaviors related to the values in this column are often very closely related to narrative aspects – for example the NPCs' ability to recognize and react to a king or similar authority figure, or how they react to institutions such as a police force. Behaviors in this category also relate to values such as the maintenance of and reactions to social roles, as well as the management of norms through etiquette and sanctions. Lastly, a special aspect of these behaviors is that of advertisement – i.e. attempting to lure other agents into buying goods and services within the world.

As stated in Paper IV (Warpefelt et al., 2013) we have found that these behaviors are often not in evidence. The least rare value is *Advertising*, but other values are rarely in evidence. Values dealing with behaviors tying into the predefined narrative of the game are somewhat often in evidence, such as *Institutions* and *Roles*. The values in this column are often products of behaviors strongly tied to the overarching narrative of the game. Therefore, the impact of these values seems to be strongly related to how well these rigidly controlled events are implemented, rather than how well the NPCs are able to produce an emergent narrative.

As can be expected, most predefined narrative behaviors contribute positively to the players' feeling of immersion. However, the behaviors associated with values such as Institutions and Roles may cause the sense of immersion to break down when they need to be performed in situations that were not preplanned and pre-scripted by the game developers, thus failing to produce an emergent narrative. Whereas values that are simple to convey, such as Advertising, can easily be predefined some values are less easily portrayed since they require a more complex understanding of the social world, e.g. Institutions and Roles. Advertising can be (and often is) reduced to simply playing an animation or a sound when the player crosses a predefined boundary. This is evident in many RPGs, where shopkeepers will play sound bites and turn

towards the player as they approach[1]. However, the more context dependent behaviors (*Sanctions*, *Norm maintenance*) require either streamlining player freedom of choice to force them to act in accordance with the story or making the NPCs capable of producing an emergent narrative. In the former case it essentially means moving towards what Aarseth (2012) calls a *linear game*, where the story is essentially immutable, whereas the latter allows for more freedom of expression for the players, or what Aarseth calls a *"creamy middle" quest game*.

5.2 Social Goals

As with the values in the *Cultural Historical* column, values in this column were generally not in evidence, and when they were they were often tied to the predefined narrative. The behaviors that were observed in Paper IV were primarily related to *Cooperation*, *Group Conflict* and *Team Player*.

The exhibitions of behaviors related to Group Conflict and Team Player were often caused by the predefined narrative, whereby NPCs would be placed on the same side in a conflict – for example the *Cerberus* enemy soldiers from *Mass Effect 3* (see Appendix B.11). The different kinds of soldiers cooperate against the player and his allies, not because the player has caused them any specific harm but rather because they are inclined to do so because of the story. This behavior is however believable in that it gives the impression of warring factions within the world.

The aforementioned soldiers also cooperate in combat, where they give each other covering fire and coordinate their attacks. This behavior is seemingly largely related to the emergent narrative, and the soldiers will adapt their tactics to provide a better challenge to the player – albeit not always successfully, as we observed NPCs moving into positions where their allies had been flanked and killed moments earlier[2]. These adaptive behaviors serve to increase the players' sense of immersion by providing a ludic challenge to the player. Unfortunately, some of these behaviors fail because of a lack of believability in underlying, lower-level behaviors found in columns to the left in the GAM. This will be explored in later sections.

[1]We have observed this behavior in multiple games including, among others, *The Elder Scrolls III: Oblivion*.

[2]This behavior was observed in *Mass Effect*, *Mass Effect 3* and *RAGE*.

5.3 Social Structural

As with the two previous columns, behaviors in the *Social Structural* column are rarely in evidence – even more so than in the previous two columns. Although we have observed some *Mob action*, and some exhibitions of *Social ranking*, these are largely by-products of other behavior. *Mob action* seems to arise when multiple NPCs perform behaviors at the same time, but they are seemingly not aware of the fact that they form a mob. Meanwhile, exhibitions of social ranking seems to arise from rules set by the predefined narrative rather than the emergent narrative. Again, a lack of support from lower-level behaviors means that many of the behaviors identified in this column cannot be performed believably by the NPCs.

5.4 Multiple Agents

The positive impact of behaviors related to this column are those that both relate to the narrative and are easy to represent. The primary example of this is the *Face to face* value, which includes that the NPCs should face the "correct" way when speaking to someone. Although this will usually include facing them directly, it may also include theatrics for added emotional impact – such as turning away in shame or rage. Furthermore, these behaviors can also strengthen the general social interaction of the NPCs, since they gives the illusion of a deeper and more animated character. Likewise, NPCs waiting for their turn in conversation (where appropriate) was also found to strengthen immersion. Unfortunately all of these behaviors also had a negative impact on immersion with an alarming frequency, since NPCs regularly fail to provide a coherent emergent narrative while attempting to exhibit these behaviors.

As is described in Paper II (Warpefelt and Stråat, 2013), and further confirmed in Paper IV (Warpefelt et al., 2013), one of the main problems with NPC behavior is the type of behavior related to the *Models of Others* value – i.e. the NPC's awareness of where other entities in the world are and what they are doing. This seems to be the most important point of failure in NPCs' behavior, and the effects propagate across large parts of the behaviors described in the GAM. In failing to uphold immersion in regards to Models of others, the NPCs preclude themselves from successfully performing related and more advanced behaviors – such as the Face to face scenario described earlier in this section, but also things such as maintaining norms and applying sanctions. However, Models of others is itself dependent on behaviors defined in the *Single Agent* column of the GAM, specifically those dealing with the perception of the world.

Lastly, one of the other major issues identified in Paper IV is the lack of

memory present among NPCs. This damages believability as the NPCs' relation to the player seems to be immutable, or only mutable by manipulation of quantitative game mechanics where the player has to fulfill certain formal criteria in order to unlock bonuses of some sort. This is in contrast to the more fluid social dynamics of the real world, where opinions change in more subtle ways than by the accumulation of "brownie points". However, this social unawareness seems to be partly related to the NPCs' inability to perceive the world. It makes NPCs seem like amnesiacs, since they are seemingly incapable of remembering previous actions performed to them, and at best only remember the outcome of the action. This is especially evident where the change in social dynamics is only temporary, such as when the player manages to provoke guards into attacking only for them to lose the trail and go back to what they were doing as if nothing had happened[3].

5.5 Single Agent

The behaviors related to the values in the *Single Agent* column display different levels of believability. Behaviors defining *acting* agents, such as the use of tools and languages, and simple navigation of the world, are by and large believable and rarely fail to uphold or improve the players' sense of immersion. The behaviors related to *reacting* agents, however, are often problematic. The failure to perform these behaviors in a believable way represents the underlying reasons why *Models of others* from the Multiple agents column fails.

As mentioned above, the NPCs' awareness of the world is one of the main issues affecting NPC believability. In Paper IV, we identified two values relating to this problem – *Awareness* and *Acquires information*. The first is the passive collection of information about the world, whereas the second is the active gathering of the same. An example of a failure to perform Awareness-related behavior in a believable way was found in *Vampire: The Masquerade: Bloodlines*, where some NPCs in a house, despite not seeing the player, automatically knew that the player shut off the power using the master circuit breaker, which was located on the outside of the house. As soon as the player flipped the switch, all NPCs inside the house instantly burst into action and attempted to attack the player. In regards to Acquires Information, a notable example is the ability (or lack thereof) of guards in *Assassin's Creed* (see Appendix B.1) to find the player after he has murdered someone and hidden. In one example, it was sufficient for the player to step behind a wall to escape, and the NPCs conducted a "search" by sweeping the immediate area. Unfortunately, the NPCs did not search adjacent areas (including obvious hiding

[3]This behavior has been observed in *Assassin's Creed*.

places, such as behind a wall) and thus missed the player.

The second type of problematic behavior is that NPCs often seem unable to adapt to changing circumstances. This causes some of the problems mentioned above with behaviors related to cooperation straining believability. This appears as an inability to handle crises, and to abort actions in order to account for new information in the game world. It has commonly been exemplified as NPCs being unable to change their behavior and abort actions as they are being attacked. In an example from *Skyrim* (see Appendix B.6) we found that a hunter was unable to abort his conversation with the player as he was being attacked by a monster. This resulted in his death immediately after the conversation had ended. A more reasonable approach would have been for the NPC to excuse himself from the conversation while he dealt with the imminent danger posed by the monster.

5.6 The way forward

In examining the problems described above, we find that there are two main problem areas hindering the improvement of believability of NPC behavior: awareness and adaptability. However, the shortcomings with regards to the second may very well be a result of the first, as it is difficult to adapt to something that one cannot detect. This has essentially proven to be the primary road block in achieving believability. This lack of awareness manifests itself in two ways: super awareness and obliviousness. Although NPCs in some cases portray an incredible ability to observe things (such as the aforementioned example from *Vampire: The Masquerade: Bloodlines*, they will often also seem oblivious to very obvious stimuli, as in the example from *Skyrim*. Both of these impact negatively on the believability of NPCs, and must be dealt with in order for NPCs to become more believable. There seems to be a "golden area" of awareness, where we accept the behavior as believable. These findings echo those of Lankoski et al. (2011), where the authors found that one of the important factors for NPC design is what they term *Awareness of Surroundings*. In Lankoski et al.'s paper, the authors present a number of different design patterns for NPC design, but many of these are still dependent on the NPCs being able to perceive the game world.

By improving the awareness aspects of NPC believability, we can consequently improve the behaviors that depend on it. This would primarily lead to improvements in the adaptability of NPCs, but could potentially unlock more advanced behaviors and allow us to improve the ability of the NPCs to portray an emergent narrative in the game.

6. Discussion and conclusions

The conclusions drawn from the work presented in this thesis fall into two categories: those relating to the behavior of NPCs, and those relating to the application of the proposed method. These are presented below, along with suggenstions for how these areas should be explored further in the future.

6.1 Conclusions regarding NPC behavior

As can be seen in Chapter 5, the gap that is evident in the research approach to NPC studies is also evident in the behavior of NPCs in commercial games. As the results in Chapter 5 indicate, the values related to narrative performance (i.e. those located in the *Cultural Historical* column of the GAM) are generally well performed if the social context can be controlled, but break down if it cannot. Many of the behaviors related to ludic values are fairly well performed, but sometimes fail.

The *Multiple Agents* column seems to define the forefront of the behaviors that NPCs are capable of in a changing social context. Behaviors related to the values in this column are often in evidence, and have both a positive and a negative impact on the believability of the NPCs. The behaviors that strengthen believability and immersion are often those that can easily be pre-defined by the game developers, and are often seemingly simple to implement since they account for few (if any) varying factors in the social context of the game world.

6.2 Conclusions regarding NPC behavior analysis

The method prestented in Chapter 4 has been proven to yield relevant results when it comes to describing the believability of NPCs. The observation based approach has proven to be fairly simple to perform, and allows the user to easily gather data in the form of video recordings. The method also displays a high level of modularity, and the separate parts of the method can be replaced without the user having to re-learn the entire method – as can be seen in the included papers. Furthermore, the results produced by using the matrix based approach allows for multiple modes of analysis. The method that gives the most relevant results seems to be the one applied in Papers III and

IV. The combination of a purpose-built evaluation tool and thick descriptions have provided deep insights into the peculiarities of NPC behavior.

One of the main weaknesses of the method is that data collection is fairly time consuming. Therefore, it is difficult and costly to achieve generalizability from the results in this method. One side effect of this is that the results presented in this thesis may be of limited generalizability. Further risks of this method include the potential for over-analysis of the data, which could potentially introduce false positives or negatives in the search for problematic NPC behavior.

The most pressing concern for this thesis, however, is the issue of theoretical saturation. Although the method itself is fairly strong, there is a possibility that the data collection has been unable to gather certain results – such as those that are evident only rarely in games or at late stages in games. If theoretical saturation is assumed to have been reached at a premature point, these results may pass unnoticed. The obvious solution is to play the entire game, preferably multiple times. Unfortunately, this approach is often unfeasible since it is extremely time consuming. As a mitigating factor, the researchers performing data collection should have had previous experience from the games. This should preferably include that they have played the game before, but could also involve them gathering knowledge from different sources, such as reviews.

6.2.1 The Game Agent Matrix

The GAM has seen multiple changes as a result of the two studies in which it was used. Therefore, it is safe to assume that is not yet a fully mature tool and that it requires further refinement. Furthermore, the values present in the GAM should be evaluated to ascertain that they are actually relevant in the context. As described in Chapter 5 some values have not been evidenced in later studies and may therefore be anomalies carried over from previous research.

Furthermore, the GAM's mutability may make it subject to overfitting if the data used to mutate it are not sufficiently diverse. It is therefore of utmost importance that studies that perform further mutations of the GAM utilize both researcher *and* data triangulation, as to avoid this overfitting.

The GAM could also be criticized for the rather liberal interpretation of the values inherited from the C&N matrix (see Appendix C). Albeit this may be detrimental in that the definitions diverge from what is expected by someone intimately familiar with the basis for the C&N matrix, it will likely not pose a problem to someone unfamiliar with that work.

Although the GAM acts well as an analysis tool, it is of limited use as a *design* tool. The raw data produced by the GAM will be of limited use to designers, and therefore needs to be processed in some way in order to produce

design guidelines. The GAM can be used as a component in a design process, but it cannot stand alone.

6.3 Discussion and future work

The results presented in this thesis indicate that NPC behavior is dependent on rigid control in order to appear believable, and that NPCs are generally poor at portraying believable behavior in changing social circumstances. The picture painted by this study is still only a rough sketch of the problem area, and therefore more work is warranted. Analysis of existing games can only take us so far, however.

This thesis presents three direct avenues for further exploration. Two of these relate directly to the GAM; development of the matrix and the associated method, and further exploration of the believability of NPCs. The third one involves using the results we have identified to develop NPCs who exhibit more believable behavior.

The first case involves further refinement of the GAM. This work should ideally include a number of new games, thus expanding the data set on which the GAM is based. In doing so, we can create a more generalizable version of the GAM. Preferably this work should also involve a larger pool of researchers, thus strengthening the researcher triangulation of the method and remedying some of the weaknesses described in Sections 6.2 and 6.2.1. Ideally, the suggestions for improving the methodology discussed in Section 6.2 should be implemented post-fact in order to ascertain if any values were potentially missed. If this is found to be the case, additional data should be gathered in order to ensure that the GAM has a more solid empirical basis.

The second case, the believability of NPCs, is best explored by expanding the factors identified in this thesis. Starting with the awareness deficiencies displayed by NPCs, the factors that influence believability can be further described. By identifying *how* NPCs fail to convey a feeling of awareness to the player, we can identify specific behaviors that need to be remedied. Fortunately these two avenues can use the same data collection. From these data we can elucidate the necessary modifications to the GAM as well as the behaviors identified as detrimental to believability in regards to *Awareness* and *Acquires Information*. In essence, these can be gathered from the same study with different analysis methods.

The third case, further developing NPCs, is fully possible with the results we have gathered so far. Doing this in parallel with the work described above would strengthen the process. Ideally, the GAM could be used as an evaluation tool for the design of the more advanced NPCs, with the output from the GAM guiding the direction of research. By applying the GAM in this way, we could

potentially bridge the theoretical gap (as described in Chapter 3) by contextualizing the ludic research in relation to the narrative by elucidating how they tie together in practice. Although the GAM provides an analysis tool, there is still a lack of design tools. Therefore, the GAM would need to be complemented with a design tool in order to provide tools for the entire design and evaluation process.

Furthermore, the research into realizing more believable NPCs should also describe *how* the behaviors should be portrayed by NPCs in other to facilitate believability in relation to sensory-based immersion – i.e. how game developers should portray frustration, happiness, annoyance and other emotions in NPCs. Although this has been an implicit part of the analysis performed for this thesis, the question of how the NPCs should present social cues and signals to the players warrants further investigation.

Finally, if the GAM were to be developed into a more mature form, it could act as a Turing test of sorts for NPCs. This could also extend into other fields, such as general believable agent research. Having a unified tool with which to analyze and describe the believability of NPCs and other agents in virtual worlds would be beneficial to the research community as a whole.

A. Non-player characters

Non-Player Characters, or NPCs, are the computer-controlled denizens of computer games. They come in many different forms and sizes, and take on a plethora of roles (see Chapter 2). NPCs serve functions ranging from nameless opponents intended only as a simple challenge to the player, to major players in the narrative of the game.

The appearance of NPCs in games is as varied as that of humans in the real world – if not more so. Depending on the genre of the game, they may take on very different forms. They may be regular humans in games that emulate our real world, such as *L.A. Noire* (see Appendix B.10), or monstrous enemies such as the Orks in *Space Marine* (see Appendix B.16). Some examples of NPC appearance can be seen in Figure A.1, where the top example is an Ork boss from *Space Marine*, and the bottom is a street scene from *L.A. Noire*, containing the player, his partner, and a hot dog vendor with a customer. Through their appearance, the NPCs send certain signals to the player. For example, a player facing a large, armored Ork would expect to fight an opponent who is skilled and hard to kill, but not very nimble. Similarly, man standing next to a hot dog cart while wearing an apron and a white hat might conceivably be willing to sell the player some food.

What both of the aforementioned NPCs share is that they have a certain level of "characterhood" – which means that they attempt to actively portray a role. In the examples in Figure A.1, we see the Ork boss actively asserting its dominance through aggressive behavior, and the hot dog vendor selling hot dogs to customers. This activity is contrasted against non-sentient things that exist in the world, for examples trees. The average tree will not be involved in the active pursuit of being a tree, but will rather just *exist* as a tree. However, trees that act in ways not generally expected of trees – for example walking around or taking captives, like the Ents and Old Man Willow from the *Lord of the Rings* books. Such action makes them actively pursue a role, and because of this they achieve characterhood.

Figure A.1: Examples of NPCs

B. Game descriptions

This appendix contains descriptions of the different games referred to in this thesis. It is intended to serve as a reference for readers who are not familiar with the games in question, as well as a refresher for readers who may not fully recall the games in question.

B.1 Assassin's Creed: Revelations

Assassin's Creed: Revelations is a historical fiction action RPG developed by Ubisoft and released on 2011. In the game, the player takes on the role of three assassins in different time periods; Altaïr in the thirteenth century, Ezio in the sixteenth century and Desmond in the twenty-first century, where Ezio is the main character. The game is the fourth game in the Assassin's Creed series.

The narrative of the game is highly linear, and the player simply has to perform missions in order to progress. However, the player is allowed to roam freely in the world and encounter its denizens. Although the player cannot directly communicate with most NPCs in the world, they can pick the pockets of unsuspecting townspeople, buy things from merchants and attack NPCs in the world. There is also a measure of law enforcement in the game, where city guards will chase the player if he commits a crime (such as murder, theft or visiting the rooftops).

B.2 Diablo

Diablo is an action-oriented fantasy horror RPG developed by Blizzard Entertainment, and was released in 1996. The game portrays a conflict between heaven and hell, and borrows heavily from Christian mythology. The player has their base of operations in a town called Tristram, which is built next to the ruins of an old monastery under which a demonic artifact is buried. The player ventures into the catacombs beneath the ruins in order to combat the demons who live there, and finally faces down the titular character Diablo. Tristram is populated by a number of colorful characters, such as Cain the Elder, Griswold the Blacksmith, Adria the Witch and Farnham the Drunk.

The story in Diablo is introduced by means of a pre-rendered cinematic, and is advanced through a number of quests and related exposition given by the townspeople, as well as through books and altars found in the catacombs below the monastery. However, the story is static and cannot be influenced by the player.

B.3 Dragon Age series

The *Dragon Age* series is a series of fantasy RPGs developed by Bioware. The first two parts, Dragon Age: Origins and Dragon Age 2 were released in 2009 and 2011, respectively. In the series, the player takes control of a main character, who is accompanied by a number of companions. These companions assist the player in fights and adventures, but also sometimes intervene in dialogues. How the player behaves affects the companions' opinion of the player, and dissatisfied companions may leave the party. The player character is often fully customizable, with the player being able to select both gender and class, as well as race in the first game.

The overall narrative of the Dragon Age series is fairly static, but it is customized to the choices the player makes. In Dragon Age: Origins, the player's class and race decide the background for the overarching narrative, whereas in Dragon Age 2 the player's class decides how the story progresses.

B.4 The Elder Scrolls II: Morrowind

Morrowind is a fantasy RPG developed by Bethesda Softworks. It was released in 2002. The game takes place on an island called Vvardenfell, which is located in the province of Morrowind, from which the game draws its name. The player is tasked with stopping an evil deity from breaking free from his prison and starting an insurrection in the province of Morrowind.

The game takes a free-form approach, where the player is allowed to roam freely about the world and progress at their own pace. Although the main story is static, there are numerous side quests to be completed and a large and detailed world to explore. In fact, the player may choose to ignore the main quest completely and instead spend their time on side quests and exploration.

B.5 The Elder Scrolls III: Oblivion

Oblivion, like Morrowind, is a fantasy RPG developed by Bethesda Softworks, and was released in 2006. In the game, the player fights to save the country of

Cyrodil from a demonic invasion. Like Morrowind, the game employs a free-roaming approach, where the player is free to move about the world as they wish. This allows the player to explore the world and to perform side missions that are not part of the main storylines.

The main story in Oblivion is fairly static, with given events that will cause it to advance. However, the large number of side quests available in the world allows the player to spend countless hours in the game. As in Morrowind, the player can choose to ignore the main storylines if they so wish.

B.6 The Elder Scrolls IV: Skyrim

Skyrim is the sequel to Oblivion (see B.5) and like its predecessor it was developed by Bethesda Softworks. Like Oblivion, it is a fantasy RPG. Skyrim was released in 2011.

In Skyrim, the player must save the world from a dragon called Alduin, who wishes to destroy the world. The game is set in Skyrim, a province in the north. Like Oblivion, Skyrim applies a free-roaming approach that lets the player pick and choose how they advance the story. The story advancement is done through special events, and the player may still take on side missions as desired. In short, the game play elements in Skyrim and Oblivion are largely the same.

B.7 Fable 3

Fable 3 is a fantasy RPG and, as is implied by the title, is the third installment in the Fable series. It was developed by Lionhead Studios and was released for the Microsoft Windows platform in 2011. In the game, the player takes control of an unnamed protagonist who must save the kingdom from a mad king and an outside invasion. The player character is fully customizable, and the player can choose the gender of the character along with how they dress and fight.

The narrative of Fable 3 is entirely static, but the game presents the player with many moral choices that affect the player's motivations for the story. These do not influence the story at large and do not change the outcome of the first half of the second game. However, during the second half the player's moral choices can greatly influence the end state of the game.

B.8 Fallout 3

Fallout 3 is a post-apocalyptic SF RPG developed by Bethesda. It is the third installment in the Fallout series originally created by the now-defunct Black

Isle studio, and was released in 2008. In the game, the player takes control of a character who is born in an underground fallout shelter called a vault. The player gets to fully customize their character, including gender, race and appearance as well as the skill set the character has. These skills can later be improved during game play.

During the game the player's father disappears from the vault, and the player is forced to flee into the wasteland outside the vault in order to find him. The narrative of the game is fairly static, but the player must make some choices that end up influencing the world. Although the overarching narrative will remain roughly the same, details in the world will change.

B.9 Half-Life

Half-Life (HL) is a science fiction FPS with a heavy puzzle element developed by Valve Corporation, released in 1998. In the game, the player takes on the role of a theoretical physicist called Gordon Freeman, who finds himself in danger when a teleportation experiment goes awry. As a result, Dr. Freeman has to fight his way out of the top secret research installation where the experiment was performed. On his way out, he faces alien invaders as well as human Marines.

The story in HL is advanced through scripted in-game events. The game takes place entirely from the perspective of Dr. Freeman, who takes on the role of the silent protagonist. However, the story is strictly controlled and the player has little actual effect on the outcome. The player is free to decide *how* to overcome the challenges posed to them, but their decision does not directly affect the outcome of the story.

B.10 L.A. Noire

L.A. Noire is a murder-mystery game set in 1950's Los Angeles, where the player takes on the role of LAPD detective Cole Phelps and solves murders. As the storyline progresses Phelps rises through the ranks, and the player unlocks new outfits and gains additional side missions (called Street Crimes).

When investigating cases, the player has to interview suspects, witnesses and persons of interest. These interviews make novel use of technology, where the interviewees are actually actors who have had their likeness captured in 3D. This approach has made the facial animations in the game very convincing. During the interviews the player must ascertain if the interviewees are lying, and if so present evidence to prove that the allegations made against the interviewee. Although this provides a rather engaging play style, the story

itself is very static and there is only one correct answer. Because of this the story will not change much between play-throughs.

B.11 Mass Effect series

Mass Effect (ME) and *Mass Effect 3 (ME3)* are SF action-oriented RPGs developed by BioWare and released in 2007 and 2012, respectively. In the ME series, the player takes control of Commander Shepard, who along with his (or her, depending on the player's choice) companions, is trying to save the Milky Way galaxy from a robotic race called the Reapers, and their miscellaneous followers.

The game is quest-based, and the player travels to different planets and progresses the story and takes on side missions. Interestingly, some choices made by players within one game may affect outcomes and options in later games in the series.

Overall the story of the game is fairly mutable, but within limited spaces. The player can essentially choose one of multiple paths, and may get different endings depending on what they choose in the course of playing the trilogy.

B.12 RAGE

RAGE is a post-apocalyptic SF FPS with some RPG and racing elements. It was developed by id Software and was released in 2011. In RAGE the player takes on the role of a super-soldier who has survivied the end of the world in a stasis pod, and who wakes up to a wasteland where the ruins of human civilization are inhabited by struggling survivors and mutants. Over the course of the game, the player explores more of the world and gets to know the story of the game, as well as that of the main antagonist *The Authority*.

As in HL, the story in RAGE is advanced through in-game events and is seen entirely from the point of view of the silent protagonist. Similarly, the story progression is tightly controlled and the choices made by the player do not affect the story as a whole.

B.13 Vampire: The Masquerade: Bloodlines

Vampire is a horror/fantasy RPG developed by Troika Games. It was released in 2004. In the game, the player takes control of an unnamed vampire who is created at the start of the game. The player also chooses a vampire clan to belong to, which influences the game play depending on the traits of the clan.

The main plot revolves around an "Ankaran Sarcophagus", an ancient artifact of interest to the various vampire factions within the game. During the course of the game, these factions compete for the artifact. The narrative of the game is fairly static, and the player has little influence on the overarching narrative – but player choice determines the outcome of the game. A large number of side quests makes the narrative seem more dynamic than it is.

B.14 Warcraft III

Warcraft III: Reign of Chaos (WC3) is a fantasy Real-Time Strategy (RTS) game developed by Blizzard Entertainment, and was released in 2002. As indicated by the title, the game is the third installment in the *Warcraft* series. At the time of writing it is the most recent Warcraft RTS to be released, but the universe has been further expanded in the later Massively Multiplayer Online Role-Playing Game (MMORPG) *World of Warcraft* (WoW), which is described in Section B.15 below.

The story of WC3 is centered around the conflict between the different factions in the world; the humans, the horde, the night elves and the undead. In WC3 the player does not take on the role of separate characters, but rather commands certain characters as special units in the game world. These characters vary depending on which story arc the player is currently playing; in the orc campaign the player facilitates the relocation of the orcs under the command of the Warchief Thrall, and in the human and undead campaigns the player controls Prince Arthas in his rise, corruption and fall as he goes from being a champion of the human realm of Lordaeron to the leader of the undead Scourge.

During the course of the game, the main story development occurs in cut scenes and pre-scripted events during the playable part of the game, where the player has little or no influence on the decisions of the characters.

B.15 World of Warcraft

World of Warcraft (WoW) is a fantasy MMORPG developed by Blizzard Entertainment. It was released in 2005, with four expansion packs added in 2007, 2008, 2010 and 2012, respectively. WoW is the successor to WC3, and lets the player take the role of a hero adventuring in the Warcraft world of *Azeroth*, as well as other locations added in later expansion packs.

Unlike its precessor WC3, the storylines in WoW is told from the perspective of a single hero. The player initially chooses to create a character of a certain race and class and belonging to a certain faction. From there the player

embarks on a number of quests, following storyliness across the different continents of Azeroth. Although the player had little perceived effect on the world in the original WoW, later expansions have added features that change how the player perceives the world depending on which quests the player has completed. However, these quests are still statically scripted and do not change much between play-throughs. In essence, the quests broadly involve killing a number of a certain monster, collecting a number of items, transporting items somewhere or interacting with things in the environment. These are strung together to create an overarching narrative within the game.

B.16 Warhammer 40000: Space Marine

Space Marine is a SF third person shooter, developed by Relic Entertainment. It was released in 2011. In the game, which takes place in Games Workshop's *Warhammer 40000* universe, the player takes control of the Space Marine Captain Titus – a genetically engineered super soldier encased in massive power armor. Captain Titus, along with his fellow Space Marines, fights to save the planet Graia from miscellaneous foes, such as space orcs and daemons.

The game follows a highly linear narrative, where the player has to complete a level in order to progress further. The player has no impact on the story itself, and must simply overcome the challenges set by the game in order to progress. The social interaction between NPCs in the game is mostly relegated to combat actions, or pre-defined interactions played at certain points in the game. The players sole controllable interaction ability is the use of violence in different forms.

C. The Carley and Newell fractionation matrix

This appendix includes the Carley & Newell fractionation matrix, which is the predecessor of the Game Agent Model. The Carley & Newell fractionation matrix was used as the analysis tool for Papers I (Warpefelt and Stråat, 2012) and II (Warpefelt and Stråat, 2013) and was introduced by Carley and Newell (1994). Note that the version included in the thesis is the adapted version of the matrix, as established in Paper I. The matrix can be seen in Figure C.1 on page 67.

C.1 The anatomy of the Carley & Newell fractionation matrix

In the C&N matrix the horizontal axis represents an increase in the social complexity of the situations the agent[1] is capable of acting in. The vertical axis represents a decrease in known information in regards to the context. For example, an agent in the upper left corner of the C&N matrix, i.e. the intersection of *Omnipotent Agent* and *Nonsocial Task*, would have full knowledge of everything within the very limited context in which it acts. Because of the limitations in context, this type of agent does not need to search for information, but rather knows everything there is to know – and the results of actions do not vary in success rate since there are no outside influences that can alter the outcome of the action.

Conversely, an agent in the bottom right corner, i.e. the intersection of *Emotional Cognitive Agent* and *Cultural Historical*, would be acting in a very complex context but would be doing so with imperfect information. This type of agent acts with imperfect information, and must acquire it as needed. Furthermore, the outcome of actions are highly variable and are influenced by social contexts and factors such as emotions.

[1]The C&N matrix was originally designed for the purposes of agents research. If the agent concept is alien to you, thinking of them as NPCs will be sufficient for the purposes of the thesis.

An agent in the C&N matrix should be capable of all the behaviors of an agent that is of a "lesser" level. Thus, an agent indexed at the intersection of *Bounded Rational Agent* and *Multiple Agents* would also be capable the types of behavior described in the cells above and to the left of the indicated cell.

C.2 The application of the Carley & Newell fractionation matrix

We have taken one major liberty in our use of the C&N matrix in Papers I and II; the use of the values in the C&N matrix as separate values rather than cumulative ones. In the initial stages of using the C&N matrix we found that this approach was less suitable for NPCs as they would exhibit behaviors that were from many different areas of the C&N matrix, without fulfilling all the requirements of the "lower level" cells. Because of this, we instead decided to consider each value independently. However, this proved to be an unwieldy approach, and as explained in Chapter 4 this was one of the reasons for developing the GAM.

Processing

Increasingly Limited Capabilities

Knowledge — Increasingly Rich Situations

	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 C.1: The adapted Carley & Newell Fractionation matrix

D. Value definitions for the Game Agent Matrix

D.1 Value definitions per column

D.1.1 Single Agent

Goal directed – Strives towards a goal in the long or short term
Route following – Able to transport itself across open ground between two points in the world
Uses language – Use of spoken or written language
Uses tools – Use of implements in order to seemingly achieve some sort of goal, for example a sword or a hammer.
Adaption – Able to adapt to changing social circumstances in the world at the given time.
Acquires information – Observes the world and seemingly gathers information on which to act.
Crisis response – Reacts rapidly to a crisis, for example if it is being attacked or if there is a fire.
Interruptability – Able to stop doing what it is currently doing when another task takes priority.
Awareness – Aware of things in its immediate vicinity.
Model of self – Knowledge of its own existence as an entity, physical or mental.
Rapid emotional response – Emotional response to actions taken by others in the world, for example the killing of innocents.
Navigation – Able to dynamically adjust its route through the world in order to account for unexpected obstacles.

D.1.2 Multiple Agents

Learns from others – Learning from the actions of others, both by example and by direct teaching.
Models of others – Awareness of the existence of other agents, where they are

and what they are doing.
Turn taking – Awareness of whose turn it is. Avoids speaking over others unless socially prompted to do so.
Face to face – Turns towards the entity it is addressing.
Group making – Dynamic creation of smaller groups.
Social interaction – Dynamic and meaningful interaction on a social leve.l
Memory of previous interactions – Remembers previous interactions of note, both direct (conversations) and indirect (seeing each other at a significant event).

D.1.3 Social Structural

Class difference – Acts on a difference in social ranking and class.
Mob action – Dynamic formation of larger groups with very low cohesion.
Social ranking – Acts on a difference in social ranking, affecting things like credibility and who has the most social power.
Coercion – Forced actions.

D.1.4 Social Goals

Disillusionment – Loss of belief in ideals.
Clan wars – Competition between groupings in the same area.
Cooperation – Ability to dynamically cooperate with other entities in order to achieve goals.
Group conflict – Conflict between groupings with different values and interests.
Patriotism – Strong dedication to parent group, for example the place of residence or clan.
Power struggles – Struggle for power between entities and groupings.

D.1.5 Cultural Historical

Team player – Concept of being part of a team, and acting for the good of the team at cost to itself.
Advertising – Advertises products and services.
Institutions – Roles and organizations with large amounts of formal or informal power and a historical connection, for example kings or universities.
Roles – Roles within society, for example police officers and farmers.
Etiquette – Observance of social rules and conventions.
Norm maintenance – Maintenance of norms and rules within society.

Sanctions – Application of sanctions towards entities and groupings that break the rules, laws or norms of society.

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