

# Social Behaviour in Games: Dynamic Identity in NPCs

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**Abstract.** The increasing use of virtual worlds in diverse areas such as entertainment, simulations and education, has not gone unnoticed by researchers and academics. With their wide application adding to the advancements in computational power, comes the interest to offer richer virtual environments that populated with agents allow a great variety of interesting social phenomena to be simulated. One of the current focal points to achieve that goal has been the agent's identity. Due to its impact in human thoughts, feelings and behaviours, researchers have been focusing on identity and on the way it can contribute to believable and socially intelligent agents. However, many of these works do not assume identity as being dynamic, when in fact identity is known to have a great dependence on the social situation the individual is in. For that reason, we believe that a dynamic identity is especially important if the aim is to build socially believable agents with the ability to adjust their identity and decisions to the situation they are in. Thus, we present the Dynamic Identity Model for Agents.

**Keywords:** context-situated agents, dynamic identity, social behaviour, social identity, video-games.

## 1 Introduction

As many scholars agree, we believe that like plays, books and movies, video-games are a form of art. However, playing a video-game is more than just watching a story written for us, it is virtually living the story. Video-games communicate ideas through familiar means such as characters, dialogue, plot and music, with the power to let the player's experience them firsthand, interacting with the virtual world itself.

In order to differentiate from the rest of the market, developers and game companies have been investing their time and money in new technologies that are bringing to video games more life-like features. Processes such as motion capture that allows the incorporation of complex movement and realistic physical interactions in character animations (e.g. Beyond: Two Souls <sup>1</sup>), or other techniques

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<sup>1</sup> [www.playstation.beyond-twosouls.com](http://www.playstation.beyond-twosouls.com)

contributing to realistic graphics, such as subsurface scattering (e.g. Crysis 3 <sup>2</sup>) or tessellation (e.g. Tomb Raider (2013) <sup>3</sup>), have been steadily providing major advancements to the visual aspects of video game's characters.

With the dramatic increases in graphic sophistication, the development of realistic behaviours has become more crucial for the character's believability as a whole. Due to that, many artificial intelligence (AI) developers have been focusing on the non-player characters' (NPCs) situational awareness. From path finding and path following algorithms (e.g. Grand Theft Auto V <sup>4</sup>) that enable characters to navigate around changing environmental conditions and to better anticipate motions that produce more naturally movements, to strategic actions that allow NPCs to use the environment to their advantage (e.g. taking cover during a gun fight) (e.g. Gears of War <sup>5</sup>), several techniques have been used to improve NPCs use of the physical environment and thus generate more complex and richer behaviour. Although some games have been already addressing dynamically shifting social circumstances (such as Linden Research Lab's Versu <sup>6</sup> and University of California at Santa Cruz's Prom Week <sup>7</sup>), very few other developments have been done to improve agent's social behaviour, even when the impact of a socially situated NPC would be great.

From a psychological point of view, social behaviours are responses of one's identity to their social environment. But identity is more than that, as it plays a wider role in people's lives. Identity is known to regulate thoughts [18, 5], feelings [6, 19] and behaviours [25, 26], but it is due to its impact on human behaviour that researchers have been focused on using identity to improve agent's believability and social intelligence. Research on agent's personality [17, 21, 22, 12] or cultural background [15, 16, 8, 10] are only some of the examples of the work done to achieve those goals. These approaches aim to provide some consistency in agent's behaviour, which is an important factor if the agent's identity is to be consistent over time. In a socially dynamic context, however, the agent's identity should be able to respond to those environment changes.

This is due to the fact that a person's identity can be extremely malleable and sensitive to details of current social situations. For example, one of the processes that greatly influences a person's identity is how one sees oneself and others regarding the membership of social groups [20, 25]. When in the presence of an out-group, the perception as group member strengthens because a person tends to focus his or her perception on the shared features with other in-group members. The person sees itself as less distinctive from the rest of its own group, and when that occurs, there is a shift in the identity (e.g. motives, values and interests) from self (personal) to the group's. But, in the absence of a strong out-group, a person becomes aware of her own uniqueness and specific

<sup>2</sup> [www.crysis.com/crysis-3](http://www.crysis.com/crysis-3)

<sup>3</sup> [www.tombraider.com](http://www.tombraider.com)

<sup>4</sup> [www.rockstargames.com/v](http://www.rockstargames.com/v)

<sup>5</sup> [www.gearsofwar.xbox.com](http://www.gearsofwar.xbox.com)

<sup>6</sup> [www.lindenlab.com/products/versu](http://www.lindenlab.com/products/versu)

<sup>7</sup> <http://promweek.soe.ucsc.edu>

personal attributes, relating to others in an interpersonal manner, dependent on her personality traits and close personal relationships, thus, using a more personal identity [1].

Just like in real life, several game genres revolve around interactions with and between game characters and more specifically, interactions that often occur in groups of characters that communicate with and act upon themselves and the player. Those groups, which normally portray a broader concept than a set of individual characters, usually represent a party of friends with same goals like in role-playing games (RPG) (e.g. Dragon Age <sup>8</sup>), a squad of soldiers fighting for the same cause such as in some strategy games (e.g. Jagged Alliance <sup>9</sup>) or society members sharing the same space as seen in some life-simulation games (e.g. The Sims <sup>10</sup>). To improve those interactions and subsequently the player's experience and immersion in games with rich social worlds, it's important that game characters have believable social behaviours while acting as members of their groups.

For all those reasons we believe that a socially intelligent agent's thinking, emotions and behaviour should be influenced by its identity. The agent's identity should be what makes the agent unique and distinctive from others, but also giving it the sense of group belonging. And, although it corresponds to somewhat established pattern of modes of thinking, emotions and behaviour, the agent's identity should be able to be moulded and influenced by the social context, with also the malleability to change slightly over time.

## 2 Related Work

Different approaches have been considered in order to create believable agents with human-like behaviour. Since a person's expressed identity can be determined by the distinct characteristics of the individual, or by the shared ones with other members of a social category he or she belongs to, current studies have been developing those two components alongside.

In order to develop unique and distinct agents there has been a growing interest on the agent's personality and individuality aspects. The work of Rizzo et al. [17] present a goals and plans-based model of personality for agents by attributing specific behaviour (personality) to the pursuit of each goal and tested in a help-giving scenario. Prada et al. [12] address the problem of creating better interactions by agents in small teamwork scenarios, by developing a computational model of personality inspired by the five factor model of personality [2] and then integrated in a model for group dynamics [13]. This model was then implemented in a game, where a group of characters and the player must search the world to find a magic item. In Tan and Cheng's work [21, 22] a framework called Tactical Agent Personality was developed that allows agents to adapt their behaviours to the player's personality, through a punishment-reward learning system. They

<sup>8</sup> [www.dragonage.com](http://www.dragonage.com)

<sup>9</sup> [www.jaggedalliance.com/](http://www.jaggedalliance.com/)

<sup>10</sup> [www.thesims.com](http://www.thesims.com)

worked upon the idea that each agent’s personality type consists of a set of actions that the agents can perform in order to adapt to the player’s strategy.

To address the social side of identity, other studies tried to achieve human-like consistent behaviour through the implementation of cultural features. Rehm and his colleagues [15, 16] build a system based on Hofstede’s five dimensional model of culture [4] and his ideas of synthetic cultures [11], where embodied conversational agents are capable of adjusting their expressive non-verbal behaviour to the user’s culture by determining if a certain behaviour is appropriate or not. On Mascarenhas et al. works [7, 8] it was developed a culturally-adaptable model, enabling agents to express different cultural behaviour through the use of rituals. This model endows agents with a set of specific social interaction dynamics, which can impact agents’ perception of others, determine how much an agent is willing to act for others, and how much the agent feel entitled to have other agents acting in his favour. Osborne [10] presented an algorithm based on the concept of social masks that works as an encouragement and discouragement system for the agent’s actions. This allows the agent to behave accordingly to the other characters social expectations, helping the agent to act fitly to social and cultural conventions of the world.

Although these and other efforts have been taken in developing agent’s own identity and individuality, these approaches have been taken separate ways and none of the systems address both concepts of identity together and working dynamically.

### 3 Dynamic Identity Model for Agents

The Dynamic Identity Model for Agents (DIMA) was developed to provide agents with a dynamic identity that is determined by the social context. An agent’s perception about its social context will have an impact on the agent’s identity which in turn determine the agent’s decisions.

#### 3.1 Agent’s Identity

In this model, an agent’s identity is not fixed, and instead it shifts between social and personal, according to the social context. So in DIMA each **agent** has a set of **social groups** that it belongs, and a **salient identity** that represents the agent’s expressed self that is influencing its decisions. The salient identity can thus range between two different levels. It can be **social**, if the agent’s group memberships become salient through inter-group differentiation, or it can be **personal** when no social identity is salient. Both levels determine the characteristics values that are going to influence the agent’s decision.

Each of those **characteristics** represents an attribute or a trait of the agents, and it’s defined by its name and a value. Characteristics can be one of two types: **explicit** if easily observed by other agent (e.g. elvish pointy ears or wizard clothes) or **implicit** if only observed by inferring mechanisms (e.g. a character’s interests, goals or moral values). When a personal identity is salient the agent’s

decision will be determined by its personal characteristics' values but, when a social identity is salient, those values are going to shift towards the values of the prototypical characteristics of that specific social group.

### 3.2 Social Context

The social context will impact the degree to which the agent behaves accordingly to its social identity. Two aspects from the social context are presently represented in DIMA: the **agents present** in the current social situation that can be introduced in the environment through their physical presence, by being referenced in a conversation or by an event; and the **theme** that brings out the characteristics that are relevant and which can be introduced on the social context either by a place (e.g. a magic forest), by a topic of a conversation (e.g. a talk about fighting skills), by an event (e.g. a battle) or by a task (e.g. hunting boars).

It is while looking at each other agents characteristics that the theme defines as relevant to the current situation that the agent calculates and perceives if it is in the presence of members with which it shares the same social group (in-group) or not (out-group). According to studies [1], towards the presence of only in-group members, the agent will express its personal identity, in the presence of out-group members, its identity will be determined by a social identity.

### 3.3 Identity Salience

The salience of a particular social identity is based on how accessible in memory that categorization is to an individual (accessibility), as well as, how well it fits the social context (fit) [24, 25]. Following Oakes's formula [9], in this model a social identity salience is the product of its fit and accessibility (see equation 1).

$$Salience_{(SI_i)} = Fit_{(SI_i)} * Accessibility_{(SI_i)} \quad (1)$$

The **fit** between a social identity and the context where the agent is situated is composed by two aspects: normative fit and comparative fit [24, 25]. **Normative fit** represents the degree to which the social group's traits and behaviours matches the ones from typical group members, and in DIMA it is calculated by how well the social categorization's characteristics matches the characteristics of a social group from the agent's knowledge base. **Comparative fit**, according to the principles of the Meta-Contrast theory [24], catches the extent of how much the in-group members are similar to each other and different from out-group members. It is defined in DIMA by the dispersion of the agent's social group (intra-group differences), and the distance between the agent's in-group and any other group (inter-group differences).

**Accessibility** of a particular social group, is the ease of bringing a given social identity to memory. It reflects the agent's familiarity and emotional valence regarding the use of that specific social categorization [25]. Identities have higher or lower accessibility depending on how accessible is that specific categorization

to the agent. Identities that have been used less times and displace less emotional valence are less accessible and the harder it is to retrieve a social identity, the less likely is for the agents to categorize themselves and others into that social identity. For each time a social identity is salient, its accessibility is updated, increasing if the emotional valence is positive and decreasing if it is negative. This way, accessibility works as a punishment/reward system that indicates the agent the receptiveness of the social identity in later situations. Because of the accessibility's updating ability, the agent's identity expression is not rigid and can change over time.

The **salience** of a social identity will be highest if both accessibility and fit are high. The higher a social identity, more biased will become the strategic decision behind the agent's behaviour.

For a more extensive explanation about DIMA see [3].

## 4 Application to Games

So, imagine a situation where the NPC from an RPG belongs to several social groups. She could be an elf, an archer and also a member of the player's party. Although she fits in those categorizations, she is also adventurous, friendly and sometimes a little bit capricious. Although these characteristics are what makes her unique, each social group also holds a set of characteristics that identifies her. Like any other elf she is very graceful and civilized, but also very suspicious of other races and specially of dwarfs, who they find a little bit rude and brutish.

Now imagine that there is also a dwarf warrior, named Kiley, in the player's party. Just like this elf, let's call her Luana, the dwarf is more than just his profession, but let us focus on Luana. Depending on how Luana sees Kiley she might approach him differently. In one extreme, if her social identity as an elf is salient, she might see him as a typical dwarf that does not know how to behave in civilized situations, however, if Luana perceives herself and him as members of the same party, she would recognize the fact that they share the same goals and interests of saving the world. Additionally, she would perceive both herself and Kiley as unique and distinct individuals, and they will interact in an interpersonal matter. They might even become close friends.

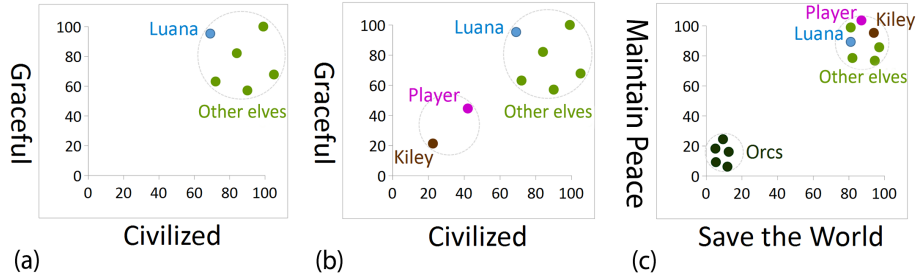
An agent representing Luana, would be defined by all the following characteristics and more, she could be: adventurous, friendly, civilized, graceful, disciplined, precise, wanting to save the world and maintain the peace. This means that for all characteristics that can be defined in our game, Luana would have increased values on all of those, some of them more than others. This set of characteristics and their values, would represent Luana's personal identity, but when a social identity become salient, depending on the characteristics that represent that social group, some of those characteristics values would shift to a prototypical group member's values. What provokes that change is tied to the social context.

So, if Luana travels to an elvish village, the relevant characteristics for comparison would be the costumes and the ways of being in a community. Luana

would group everybody present according to the characteristics “civilized” and “graceful”, and she would perceive to be among other people that she would consider in-group members. In that situation, she would relate to others in an interpersonal manner and her decisions and behaviours would be influenced by the values of her personal identity characteristics (see (a) from Figure 1).

However, when the rest of her party enters the gates of her village, the social context changes. Although the relevant characteristics for comparison remains the same, the members present have now two new additions, Kiley and the player. In this situation, Luana will group again everyone according to the same characteristics, but now she is aware that Kiley and the player together are not elves, and thus are members of an out-group. Due to that, her social identity as an elf will become stronger, and the strength of that social identity salience will determine how much of the Luana’s characteristics will shift to the prototypical member of the elves. She will behave more like an elf than before, but since this out-group is not very opposing, Luana is not really much affected by her elvish culture background, yet, this social identity salience is enough for her to notice how different the other two are. Particularly the dwarf that does not even know how to behave in a civilized way (see (b) from Figure 1).

Luana’s concerns about the dwarf and the player soon would fade, as her village is, unfortunately, suddenly attacked by a group of vicious orcs. In this new situation a stronger out-group is now present, and these orcs are distinct enough for Luana to now group both player and Kiley, as well as all the other elves as in-group members. They know that the orcs are preparing for raiding every town there is, and in this particular situation, Luana and her group goal is to save the world and maintain the peace (see (c) from Figure 1).



**Fig. 1.** (a) the absence of an out-group results in the expression of a personal identity; (b) low inter-group difference and high intra-group difference results in lower social identity salience; (c) high inter-group difference and low intra-group difference results in higher social identity salience.

As shown, these different dynamics in an NPC’s identity are due to changes in context and the members present, therefore, player’s decisions on which places to go, how and which events happen, or what other characters are around them, can

impact an NPC's behaviour. This not only gives the game some replayability, but also the feeling that as a player, our actions can have consequences and impact on others. Additionally, because the NPC's views of the player or its party can change, some unscripted but interesting intra-group dynamics might emerge, such as confrontation between two party members that force the player to intervene; a new perception of the player as enemy that could lead to betrayal; or even the need to abandon the player's party due to a loss of identification with that group.

## 5 Example of implemented scenario

DIMA was already implemented on a research tool developed within Project INVITE<sup>11</sup> (social Identity and partNership in VIrTual Environments) [14]. Within this project a research tool was developed that is fully parametrized, allowing the creation of several different scenarios and case studies in the form of a multi-player 3D video-game where both humans and virtual agents can participate. It allows the configuration of a myriad of game theory paradigms, from the classical prisoners dilemma to more complex team games, such public good games, where conflict can be present at both in-group and out-group level.

### 5.1 The Game

The game begins after a plane crash on a deserted island. Because of the existence of an active volcano players must evade the island before its eruption. Players are assigned into camp sites, with each camp site having the goal of constructing a raft in order for its members to survive. Each day, each player has a number of hours at their disposal to collect resources. In order to build the raft, players should collect wood for their team. If the team of a camp site is able to build a raft before the volcano's eruption, the members can use the raft to escape. In that situation, the raft is sold and the earnings obtained are converted in a bonus in gold and distributed to all team members. However, gold can also be found scattered all over the island. In the end, the player that survives with more gold wins the game. Players are then faced with the dilemma of either helping everyone by collecting wood (team's interest) or gathering gold and thus become rich when they escape (personal interest) (see Figure 2).

To configure a new experiment in the INVITE framework a set of parameters must be defined in the INVITE configuration tool. Examples of those parameters are: the number of turns until the volcano erupts (end-game condition); number of camp sites; number of players per team (that could be a mix of humans and agents); visual characteristics for each avatar; total wood necessary to finish the raft; number of resources (wood and gold) each player can collect; among others.

<sup>11</sup> <http://project-invite.eu/>





**Fig. 2.** INVITE game's view of the island with two camp sites.

## 5.2 Dynamic Identity in the Game

The agent behaviour in this game is composed by two elements: the strategic reasoning and the social bias from social identity.

Strategically, the agents will try to maximize the amount of gold they collect in order to win the game, but since the volcano gives visual clues about how close it is to eruption throughout the game, we also included this sense of urgency on the strategic reasoning of the agents. It is expected that by following purely this strategic process the agent prioritizes self gains in the beginning of the game, however, as days passed and the volcano eruption chances increase, the quantity of wood collected by the team starts to take more importance in the decision and if the wood is too low, the agent starts to prioritize its survival, and starts gathering wood. Nonetheless, the agent might also remain in its position as a free rider, if other players keep getting wood for their raft, granting their surviving. This happens because the agent is not only able to adapt its behaviour to the imminent danger of its environment, but also to other players' behaviour.

The process of social identification however, may lead to a bias in decisions. In this scenario this bias is achieved by combining the probability of cooperation given by the strategic decision model with the value of the salience of the active identity obtained through DIMA. The salience of a social identity, which is calculated taking into account the members from the agent' campsite, determines

the probability of cooperation with those members. Depending on the characteristics these members are sharing (e.g. uniform colours) the social identity can be more or less salient and thus the cooperation more or less frequent among them.

## 6 Conclusion and Future Work

With digital games increasing complexity, it has become even more important to develop agents that can interact with their world in a believable way. In order to sustain the players immersion, game characters should not only be aware of their surroundings, but also act accordingly to the social situation they are in. In order to do so, we believe in the importance of developing a dynamic identity for agents, with the potentiality to act upon the agents thoughts, feelings and behaviours in a human-life-like way. With that in mind, we developed the Dynamic Identity Model for Agents and tested in a simple game scenario where individual interests compete with the group's ones.

But the truth is that many video-games revolve around more complex social categorizations and with this in mind we presented in this paper how we envisioned this model in a future state. In many video-games, different options - in the form of professions, classes, or even factions and teams - are offered to the player to choose from. In fantasy role-playing games, worlds are populated by humans, elves and orcs - each of them with their specific backgrounds and abilities. In multi-player strategy and also shooting games is common to have different teams composed by a group of people with a common goal yet different from one another. Those teams or groups normally compete with each other, creating a sense of belonging to the players and improvement in the game dynamics. In games populated with tens of thousands NPCs, such as in massively multi-player online RPGs, each of them belongs to several groups and social categorizations. In all these examples this model might give rise to a lot of interesting group phenomena, where each character goals could be met and their behaviours emerge in unplanned ways yet always consistent with the world itself.

With more work we hope DIMA could be used to improve those scenarios. It is now possible to generate agents with a dynamic identity that is context situated, where depending on the members present and the relevant aspects from the environment, the agent's identity can shift from personal to social. When that happens its strategic decisions become biased. Because in social situations this effect normally leads to increased cooperation rates with the group, this can be quite important in games where competitive and cooperative scenarios play an important role.

In order to increase the reach of DIMA in a video-game scenario, as future work we plan to extend DIMA to include the possibility of multiple identity salience, as well as relations between them, such as reinforcement or conflict between the salience of two or more identities [23]. In many social situations it is possible to have factors that increase the salience of several identities, and some identities can have opposite forces between them. Either between a per-

sonal and a social identity, or between two social identities situation (such as a character that is half human and half orc). We would also like to improve the normative fit process to allow the agent to be able to deduce more of the other agent characteristics than just the few it is actually perceiving. This kind of stereotyping would translate in new information that the agent could use in its decision planning, but could also be used as player modelling, in order to derive possible player's behaviour and choices within the game.

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