

CiF-CK: An Architecture for Social NPCs in Commercial Games

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Abstract—We present and describe CiF-CK — a social agent architecture that models reasoning about persistent social interactions to improve narrative engagement and play experience for human interactors. The architecture is inspired by McCoy et al’s *Comme il-Faut (CiF)* architecture that represented rich social interactions between agents that included feelings, social and relationship contexts, and longer term mood. The key contribution of this work is in adapting the richness of social interactions from CiF to a first-person interaction experience and a released distribution of its implementation on the Skyrim game engine. The released modification has been successful in the player community for the popular game.

I. INTRODUCTION

Modern video game have reached a new level of graphic fidelity. Furthermore with the rise of popularity of new technologies such as Virtual Reality and Augmented Reality, gamers are more immersed than ever within virtual worlds and its virtual characters. With the level of real life likeness of the game world increasing so does the player expectation of real life like interaction [1]. This expectation is extended to the characters that compose the environment, typically called Non Playable Characters (NPCs), because their behaviour is defined by the programmer. Both computer controlled characters and player controlled avatars need to act in a believable manner so that the illusion of reality created by exquisite graphics and physics, the “player immersion”, is not broken [2].

The credibility and believability of NPCs requires characters to have basic human traits like emotions and the ability to make decisions on their own [3]. One of the most important human traits is our social ability and awareness. People’s thoughts, feelings, and behaviours are influenced by the presence, even if just imagined, of other human beings. This makes rich agent modeling important for human interaction within these environments. One key aspect for agent models is affinity with the player’s social concerns and behaviours [4].

Most modern day AAA video games, with the highest development budgets and levels of promotion, are heavily dependent on a high number of NPCs and rely on the Player’s interaction with them to advance the game’s narrative. Unfortunately, most of the NPCs do not exhibit deep social reasoning and most of the times are simply frozen in time, repeating the same action, if any, over and over again [5].

Modern social architectures/models, originating from academic research groups, have the potential to transform videogame’s NPC interaction to open up rich narrative design spaces for players to explore. These models allow the system to automatically manage and keep up with the complexity of social interactions, reducing the number of experiences that need to be explicitly authored [6]. Reasoning about the social context in terms of relationship goals and desires, social status, and emotional changes is central to believable behaviour [7].

Academic research on AI in games and commercial game AI development efforts are rather disjoint. This is the result of academic research and commercial game development trying to solve different problems: academic researchers want general solutions to generic and preferably deep problems, whereas commercial developers want something that works well enough and looks good enough in a particular context [8]. For example, as a result of researching Interactive Storytelling (IS), the video game “Façade” [9] was created and became regarded as the future of IS (and still is widely cited in IS research) [10]. Despite its success and popularity as a game, there is still a gap between the technology and development tools that could make it accessible to a wider population of developers and users of such interactive experiences.

This project’s goal was to develop and implement a social architecture model, inspired in academic research, in a modern and commercially successful video game and investigate its impact on player experience. Open World Single-player Role Playing Games (RPG) are games where players free roam a world filled with villages and cities and hundreds or thousands of NPCs. Thus this is the type of game where the implementation of a Social Agent Architecture can have more impact, both in terms of Player Experience as on the softening of the authoring burden. We chose to implement the social architecture in a video game of this class: “The Elder Scrolls V: Skyrim” [11]. The choice of this particular game was due to its popularity and high “mod-ability”¹.

¹It is possible to access the original game’s AI constructs and use, adapt or change them, without needing to modify the source code of the game

II. RELATED WORK

Researchers have addressed the problem of socially intelligent agents and created various different social simulation models. However, different architectures fit different games, and, before deciding which is more appropriate for this project we need to take a deeper look at the game.

A. A Single-player RPG Example:

The Elder Scrolls V: Skyrim

The Elder Scrolls V: Skyrim is an action role-playing open world video game developed by Bethesda Game Studios and published by Bethesda Softworks. It is the fifth installment in The Elder Scrolls series, it was released worldwide on November 11, 2011, receiving critical acclaim. It has sold over 20 million units² and 5 years after its launch it still has a broad and active user base, around 30 000 different daily concurrent players.

Over the course of the game, the Player can interact with over 600 different NPCs through dialogue that reflects the NPCs importance and role within the Skyrim world. The game was developed using the Creation Engine. Bethesda decided to releasing a modding tool for the game by releasing the Creation Kit tool.

B. Creation Kit

Creation Kit development tool is a powerful piece of software as it is the same tool that Bethesda itself used to create Skyrim. Almost everything the developers used is available to the “modder”. Users can use those resources or add new ones. Plugins, or “.esp” files, are smaller collections of data which can be loaded “on top” of master files. These type of files allow us to implement our architecture on top of the already built game world without overwriting the original.

The Elder Scrolls V: Skyrim is built with many thousands of objects and they are all available to the modder in Creation Kit. These objects are presented in the Object Window that separates each entity in their proper category. If users want to find a particular NPC called “Sabjorn” it can be found under the Actor folder. The Creation Engine’s definition of Actor is very similar to what we consider an NPC, as such, we will consider them as the same.

1) *AI Packages*: In order to give Non-Playable Characters its behaviour and not have to manage it constantly, the Creation Engine gives every Actor a list of AI Packages that it will execute. Packages are the main way in which one can control an Actor’s behaviour. Each Package represents a behaviour that the Actor will perform under certain conditions³.

2) *Quests*: The original Skyrim game, just like most Role Playing Games (RPGs), has hundreds of quests. Quests have multiple functions besides delivering a narrative. Some exist to simply store dialogue, others to manage random events that happen in the world. The main components of a quest are:

- **Quest ID**, unique identifier for each quest.

- **Quest Stages**, represents the phases of a quest, all of the stages can have starting conditions and ending conditions, for every quest there is always a starting stage and an ending stage.
- **Quest Aliases** are the references to the objects that are used during the quest, these might be characters, items and even other quests. This allows various data elements to be tagged to the alias rather than to a specific object in the world allowing quests to specify their aliases at runtime instead of being predefined⁴. This particular ability makes it possible to reuse each Quest with different participants or values.
- **Quest Scripts** are used to apply the effects of the quest in the Game World, often used to transition from stage to stage and to execute scenes.
- **Quest Scenes**, the physical performance of a quest. Scenes use temporary AI packages that override the others. A scene can be, for example, making a courier deliver a letter to the player.

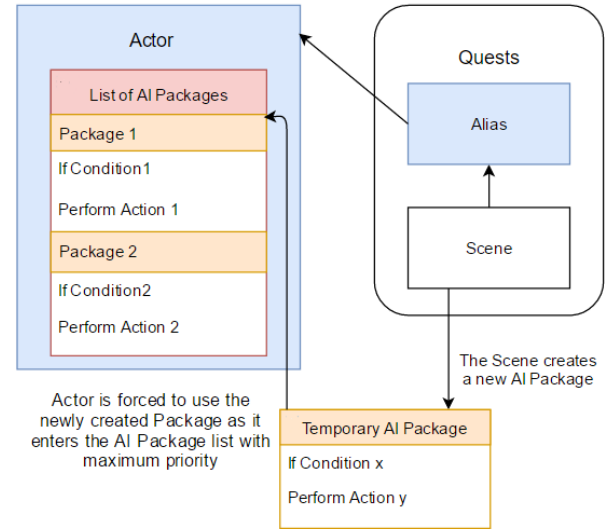


Fig. 1. How Scenes force an NPC to perform a desired action in Skyrim

C. Social Architectures

In our search for a model that we could implement in a commercial game we looked at some available social simulation architectures.

1) *PsychSim*: Psychsim is an agent based system to simulate social interactions. A unique aspect of the PsychSim design is that agents have fully specified models of others [12]. PsychSim allows a user to quickly construct a social scenario where a diverse set of entities, groups or individuals, interact and communicate. Each entity has its own preferences and relationships with other entities. The simulation tool generates the behaviour for these entities and provides explanations of the result [13].

²<http://www.statisticbrain.com/skyrim-the-elder-scrolls-v-statistics/>

³<http://www.creationkit.com/index.php?title=Category:Packages>

⁴http://www.creationkit.com/index.php?title=Quest_Alias_Tab

2) *GAMYGDALA*: GAMYGDALA is an emotional appraisal engine that enables game developers to add emotions to their Non-Player Characters. For each NPC that needs simulated emotion the game developer specifies goals, and annotates game events with a relation to these goals. Based on this input, GAMYGDALA finds an emotion for that NPC according to the well-known OCC model [14].

3) *SGD*: Support Group Dynamics model defines the knowledge that each individual should build about the others and the group, and how this knowledge drives their interactions [15]. It implements behaviour patterns inspired by results from social sciences that allow agents to generate human-like group behaviours [16].

4) *FAtiMA*: FAtiMA (Fearnot Affective Mind Architecture) is an agent architecture with planning capabilities that uses emotions and personality to influence the agent's behaviour. In recent years, the architecture was used in several different projects, such as FearNot! [17], ORIENT [18], RAGE [19], and by different research institutions [20]. This resulted in the creation of a modular version of the architecture, where functionalities are divided into independent components. Based on cognitive appraisal theory of emotions [21], the FAtiMA architecture offers a generic appraisal framework where a set of different basic emotions and the coping behaviours can be generated according to a set of goals and preferences for a virtual agent [22].

5) *Comme il Faut*: Comme il Faut (CiF), that roughly translates to “as it should be”, is an artificial intelligence system and authoring strategy for creating game-based interactive stories about relationships and social interactions between characters [23]. In CiF the characters use many attributes of the current social state, including the history of prior interactions, to decide how to engage in these multi-character social exchanges. The goal of this architecture is to provide a rich social environment for the characters to interact.

Instead of compressing all domain knowledge in nodes or states, like many AI techniques do, such as Behaviour Trees and Hierarchical Task Networks, CiF chooses characters' behaviours based on rules in a large rulebase that depict normal social behaviour in a particular story world [24]. CiF doesn't create a static, or even branching, series of events, but rather the logic of a social world, a set of characters, and a series of scenario goals. Because CiF is driven by simulating social interaction, goals may be met in unplanned ways, but are always consistent with the designed story-world.

CiF has been used in games with a high social focus such as Prom Week with great success [25]. Additionally, there was an attempt to build a text adventure game from the ground while taking into consideration the requirements of the social model, called “Mismanor” [26].

6) *Discussion*: It is fundamental that the architecture used can be adapted to an already finished video game (as in, no access to the source code or the internal structure of the game). Instead of building completely new agents with new AI we are adding to the existing game world characters additional behaviours, without overriding the original ones.

Of the architectures discussed previously, the Comme il Faut architecture does not require any major changes to an already built game world and its structures. It is relatively “light” (when compared to the others), easy to comprehend and seemingly simple to adapt. Additionally the structures present in CiF, namely the notion of Social Exchange, can be mapped to the elements present in Roleplaying Games and that are also present in Skyrim and the Creation Engine. As a result the architecture we've chosen to test our thesis, and implement it in Skyrim, is the Comme il Faut social architecture.

An in-depth description of The Comme il Faut architecture can be found in [6]. Here, we present a brief descriptions of its structure and components.

D. The Comme il Faut Architecture

The work on *Comme il Faut* (CiF) started with the goal of generalizing multi-character exchanges, social interactions, into reusable units. This allows the creation of multi-character social exchanges more generally that can then be targeted to specific characters in specific situations. The CiF architecture can be described in four essential components:

- **Social State**
- **Characters**
- **Social Exchanges**
- **Trigger Rules**

Figure 2 describes how each component relates to the other. In short, NPCs perceive the Social State around them and try to change it to accomplish their Social Goals. To change the Social State they make Social Exchanges such as, Flirting with another NPC. These Social Moves might be successful or unsuccessful, in both cases they have consequences once they have been executed. According to its success or the lack thereof the effects of each Social Move change the Social State and we go back to beginning of the cycle. Furthermore, at any moment in the cycle any stage can have unforeseen consequences. These unforeseen consequences are handled by the Trigger Rules that if they are “fired” also affect and change the Social State.

1) *Prom Week*: The Comme il Faut architecture was used in the video game “Prom Week”. Prom Week is a game that goes through the week leading up to a high school prom. The Player can control all the characters and decide what social exchange should they perform and with whom. Prom Week simulates the results of the interaction chosen and shows its effects to the Player. The consequences of each character's action can influence its “Coolness”, “Friendliness” or “Romance” levels. These are called Social Networks. They are used by CiF to measure the relationship between any two characters. Every character in every network has a link to every other character, and no character has a link to himself [27].

III. SOLUTION ARCHITECTURE: CiF-CK

Our adaptation of the Comme il Faut architecture to RPGs in general and to the Creation Kit is called the **CiF-CK** (Comme il Faut Creation Kit) architecture. When describing the Comme il Faut architecture we mentioned four essential

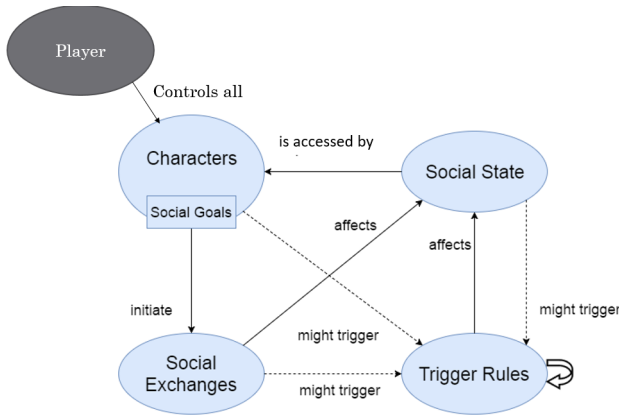


Fig. 2. Simple representation of CiF components and the relation between them in Prom Week

components to this model: the Social State, the Characters, the Social Exchanges and finally the Trigger Rules. Lets now take a look at how each essential component was adapted along with some innovations to CiF made in CiF-CK .

A. Social Exchanges

In most Role Playing Games everything revolves around quests. Skyrim follows this tradition. From making an NPC talk to the player or to sit on a specific chair, from complex main narrative storylines to simple “collect some plants” missions, at least one quest needs to be executed. Quests are used to store variables, dialogue, actors, performances and even locations.

The primary knowledge representation element in CiF is the Social Exchange, a collection of patterns of (primarily dialogue) interaction where the exact performance and social outcome varies based on the personality-specific attributes of the characters involved and the current social state [28].

The similarity between Quests, in RPGs, and Social Exchanges, in CiF, allow us to adapt one to the other. We can use Quests the same way Social Exchanges are used in CiF, with some adaptations. We exhibit this transition in Table I.

For example, lets say that Sarah wants to Flirt with John. The Quest Flirt is started and its Initiator is Sarah and its Target John. The instantiation of the Quest is composed by a conversation between Sarah and John in which Sarah flirts and John responds. Depending on the response different Social State changes might be applied. These include improving the NPCs’ relationships and perspective of each other. Finally, some Trigger Rules might be fired. These would bring even more changes to the Social State. In our example, if the Flirt Social Move succeeded, John’s attraction for Sarah increases, in turn, Sarah’s beliefs that John likes her (in case his response was positive) also increase.

B. Characters

In order to fully capture CiF’s architecture we also need to improve upon the Characters created in Skyrim (and in most RPGs). In order to capture that additional behaviour it

TABLE I
SOCIAL EXCHANGES: FROM CiF TO CiF-CK.

CiF	Function	CiF-CK
Name	Unique Identifier	Quest ID
Intent	Pretended Social State Change	Used once the Quest has finished
Pre Conditions	Conditions for it to happen	Quest Start Conditions
Initiator Influence Rules	Character’s Desire to initiate the exchange	Set of Rules
Responder Influence Rules	Target’s Reaction to the Exchange	Set of Rules
Effects	The resulting consequences of the Exchange	Applied in the Final Stage of a Quest
Instantiations	Performance of the Social Exchange	Dialogue between NPCs

was necessary to implement certain key variables described in Table II.

TABLE II
HOW CHARACTERS IN CiF TRANSLATE INTO THE CiF-CK MODEL

CiF	Function	CiF-CK
Name	Unique Identifier	Unique identifier
Gender	Describe the Character’s Gender	Permanent value
Traits	Permanent Traits	Permanent values that affect social exchanges
Status	Temporary Traits	Temporary values that affect social exchanges
Prospective Memory	Set of desires of social exchanges with specific goals	Set of quests with specific actors (Targets)

C. Social State

In CiF, the social state of the world is captured by four different representations: Social networks, Relationships, the Cultural Knowledge Base, and the Social Facts Knowledge Base [28].

Because of the large dimension of these types of games, RPGs, and in order to not take a huge load on memory of the players computers, Engines render and compute only what is in the surrounding area of the player controlled character [29]. This is standard practice when creating video games with vast worlds and locations. As a result any script associated with an NPC that is in a different place as the Player will not be processed. This fact will influence our implementation as NPCs will only be considered and will only consider those in the same place as the Player.

In order to store all the data the Social State captures we use a Static entity that can be accessed by anyone at any time. while in CiF the Social State is public, in CiF-CK the Social

Networks and preferences of each character are private. Table III describes how the Social State Components of CiF are represented in CiF-CK.

TABLE III
HOW THE SOCIAL STATE IN CiF IS REPRESENTED IN CiF-CK.

CiF	Function	CiF-CK
Social Networks (Public)	Feelings characters have for each other	Unique for each Character (Private)
Relationships	Publicly recognized relationships	Public information is stored in a static reference and accessible to all
Cultural Knowledge Base	What each NPC likes	Unique and different for each Character
Social Facts Knowledge Base	Social History of the World	Public information is stored in a static reference and accessible to all

D. Trigger Rules

In CiF, Trigger Rules can be “fired” at any point in the game and have cascading effects in the Social State [28]. In order to be more efficient and avoid stressing the Game Engine, CiF-CK only verifies the trigger rules when a Social Exchange ends. In our Model, Quests are the only component that directly influences the social state, as such, CiF-CK runs all trigger rules when a quest ends, either by failing or succeeding, making sure if one of them triggers we can apply it and its consequences to the Social State right afterwards.

E. Beliefs and Social Networks

In CiF, Social Networks are scalar, non-reciprocal feelings characters feel towards others. Our Model supports any number of Social Networks. In our implementation however, we used only two: Attraction and Friendship. These networks model the relation of social attraction and friendship, first studied by Moreno [30], which reflects the affective ties that one person establishes with the others.

In CiF-CK we added a new feature to the Comme il Faut architecture. We considered that the Social State is something Characters perceive, however, it might not be the actual reality [31]. For example, Sarah might think John likes her, despite the fact that John actually hates her. Because Sarah believes John likes her, she will act accordingly.

F. Player to NPC interaction

In RPGs the world is centered around the Player. As such, NPCs should not just interact with each other but also take into account the Player and its Avatar. In CiF-CK, the Player can be both the Initiator or the Target of Social Exchanges. NPCs take the Player into account in their Social Goals and perform Social Exchanges accordingly. In turn, the Player may perform any Social Exchange available towards any NPC.

Figure 3 gives us an overview of CiF-CK architecture and where each of the CiF’s elements compared to Figure 2.

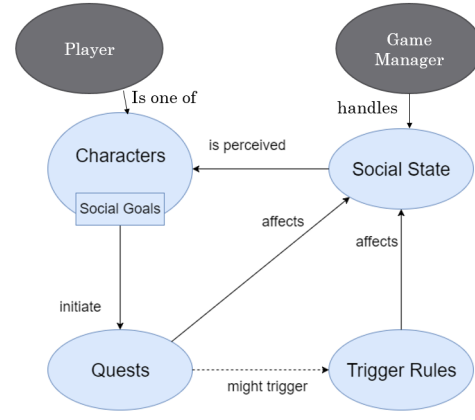


Fig. 3. Simple representation of CiF-CK components and the relation between them

IV. IMPLEMENTATION

We implemented the CiF-CK architecture in a mod for Skyrim, in order to test its success and impact on the original game. In the resulting mod we created 12 different social moves described in Table IV. Each Social Move, along with its consequences, is based on similar Social Exchanges described in Prom Week [25].

TABLE IV
TYPES OF QUESTS/SOCIAL MOVES AVAILABLE IN THE MOD

Type	Name	Intent
Romantic	Flirt	Increase Romance
	Offer Romantic Gift	Increase Romance
	Ask Out	Add Status: “isDating”
	Share Feelings	Add Status: “areLovers”
Friendly	Compliment	Increase Friendship
	Offer Gift	Increase Friendship
UnFriendly	Insult	Decrease Friendship
	Embarrass	Decrease Friendship
	Spread Rumors(C)	Decrease C’s Friendship
Hostile	Fight	Drastically decrease Friendship
Special	Break-up	Remove Status, Decrease Attraction and Friendship
	Hello	Add Status “Acquaintance”

We chose Romance and Friendship because of their relevance to the context of the implemented scenario, that is directly inspired from the same theoretical background in social sciences as CiF. However, if the author wishes to represent other Social Dimensions it can use CiF-CK by specifying the Social Networks, Social Moves and the Trigger Rules that affect them.

We have also implemented 5 different Traits such as, “Friendly” and “Hostile”, and 4 different types of Status such as, “Angry At” and “Drunk”, each one influences the NPCs

decision making and social goals formation. We can easily change an NPC's traits by changing the keywords attached to them which in turn will change their personality and consequently its decision making.

1) *Scripts*: The internal structure of the CiF-CK mod can be defined by three components:

- CiF-CK script, manages the NPC's decision making cycle.
- Influence Rules script, the auxiliary script that calculates all the volitions for all the social moves to be performed by its owner NPC.
- GameManager script, manages the social state of the location that the Player is in. It receives information from all the "Social" NPCs and decides which one is going to perform a social interaction next, it also notifies all other NPCs of what has happened in the social state around them.

Every NPC has both the CiF-CK script and the Influence Rules script. There is just one GameManager throughout all the gaming experience that, for technical reasons, is associated with the Player Entity. The internal structured is described in Figure 4.

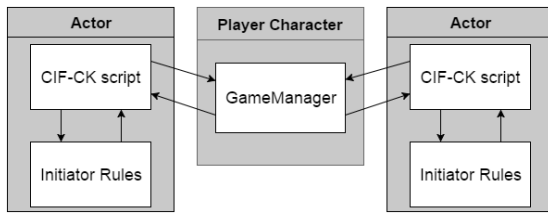


Fig. 4. Internal Structure of the mod

A. Player to NPC interaction

When playing the CiF-CK mod the Player can interact with any Social (modded) NPC it wants. In Skyrim, these interactions are (mostly) done through dialogue. When the Player starts a conversation with a "Social" NPC it is presented with some dialogue options that were not available in the original game. The idea is to "mimic" the actions that NPCs perform towards other NPCs and give the Player the option to perform some of those Social Moves. All of the performed Social Exchanges have a response that depends on their Beliefs and Goals. We can see some of the dialogue options, in game, in Figure 5. In the final version the Player can:

- Greet the NPC if they haven't met yet.
- Offer the NPC a gift from the Player's inventory.
- Compliment the NPC.
- Insult the NPC.
- Flirt with the NPC.
- Ask the NPC out on a date.
- Propose to the NPC.
- If they are on a relationship, break up with the NPC.
- "Bad Mouth" other NPCs around them.
- "Praise" other NPCs around them to the NPC.



Fig. 5. Some of the Player dialogue options when speaking to a Social NPC.

V. VALIDATION

To better test the impact of CiF-CK in the Player Experience we designed two different playable scenarios within the mod. Each plays slightly different from the other and serves different purposes:

- **Quest Scenario**, the first scenario is a small Narrative experience that Players can work around, using CiF-CK, with specific Characters and within a very specific drama. The idea behind this scenario is to give the players a taste of what some stories and quests could be if they used a similar Narrative Structure to normal Skyrim side-quests but with our "Social NPCs" instead. This Scenario takes place in a newly created: "CiF House" located near the city of Whiterun.
- **Open Scenario**, the second scenario is a place where the player can experience the addition of Social Ability to already existing NPCs within a more open and "sandbox" situation. The idea behind this is to try to understand if players interact more than they used to with previous NPCs. It is also of our interest to understand if players, without any "special" motivation, can create storylines on their own. This second scenario takes place in an already existing location near the first scenario, called "The Honningbrew Meadery".

A. Mod Release

The mod containing CiF-CK implementation and the Player Scenarios is called "Social NPCs" and was released in the 26th of August (2016), both in Steam Workshop⁵ and in the popular mod website: "Nexus Mods"⁶.

In the first 40 days after its release it had been played by more than 6 000 different players and more than 70 000 users had visited the mod's web page. In Steam it reached a 93% approval rating, out of 194 ratings (181 positive ratings and 13 negative) in and became "Top Mod of the Week" because of its high popularity and rating.

In total there were over 180 comments, spread across platforms and discussion forums, from both mod users and

⁵<http://steamcommunity.com/sharedfiles/filedetails/?id=751622677>

⁶<http://www.nexusmods.com/skyrim/mods/77792>

more importantly, mod creators. The vast majority of which provided very encouraging feedback, very interesting suggestions and questions about implementation and authoring.

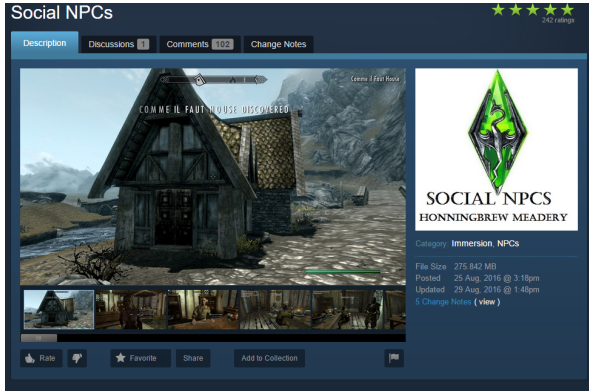


Fig. 6. Screenshot of the CiF-CK Mod in the Steam Workshop from 5th April 2017. Some numbers from that date: 11,614 Total Unique Subscribers (downloads), 70,218 Unique Visitors and 226 Positive Ratings (93 % of Total).

B. Survey Results

Because of its high degree of commitment and immersion, typical RPG Player experiences last for hours. We wanted users to keep playing the game as long as they want and that their transition to the mod “gameplay” was as seamless as possible. Additionally, we were highly interested in veteran Skyrim users that can notice the improvement we have made to the characters of the original game. As such, we opted to perform an online survey that was presented in the mod’s description web page. All participants that answered the questionnaire were presented with the same options, the questionnaire had questions focused on believability, player experience and engagement [32], [33].

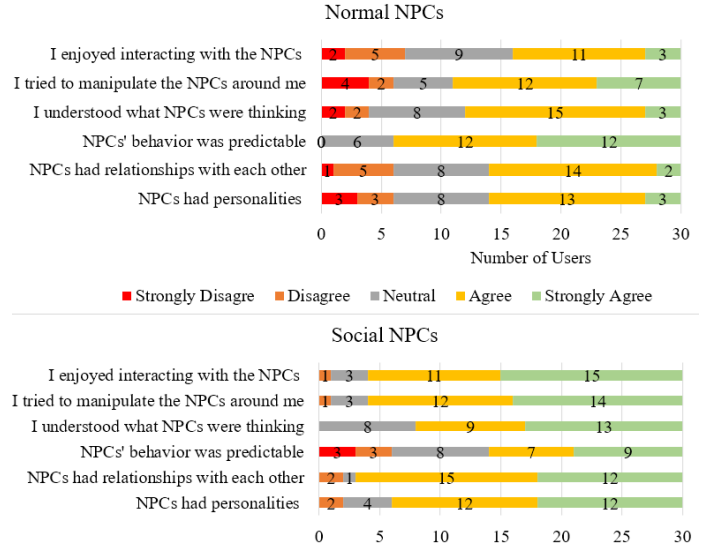
The general CiF-CK mod user is a veteran Skyrim player that enjoys the game at least 5 hours a week, has used over 20 mods and has played Skyrim more than 100 hours in total.

Regarding the “Quest Scenario”, users felt that the Quest we designed was more flexible when compared to Normal Skyrim Quests (73%, 17 out of 23 answers). Additionally players enjoyed interacting with the NPCs (95% of the answers, 22 out of 23) and tried to manipulate them in order to achieve their own goals (91%, 21 out of 23 participants). Regarding the time spent in the experience: 37% of the users spent 15 to 30 minutes in the CiF House, another 17% spent over 30 minutes while 23 % didn’t know.

In the HonningBrew Meadery scenario 48% of the users spent between 11 to 30 minutes in the House, with another 20% spending over 30 minutes. Because the “Open Scenario” added functionality to previous existing NPCs we used it to compare the differences users felt between Skyrim original NPCs and CiF-CK based “Social NPCs”. In order to achieve that goal we used a 5-point Likert scale twice, where users were asked to identify their level of agreement with a set of sentences. The phrases tested for believability and user interest. The results are shown in Figure 7 the first graph is

regarding normal Skyrim NPCs and the second is regarding the CiF-CK NPCs.

Fig. 7. Player’s agreement level on a 5-point Likert scale



Performing Wilcoxon Signed Rank Tests in order to compare the difference between results, all were significant with $p < 0.01$:

- NPCs’ predictability levels were lower using Social NPCs when compared to Normal NPCs, $T = 26$, $p = 0.008$, $r = 0.4873$
- Users’ comprehension levels were significantly higher using Social NPCs when compared to Normal NPCs, $T = 24$, $p = 0.001$, $r = 0.582$
- For users, enjoyment levels were significantly higher using Social NPCs when compared to Normal NPCs, $T = 0$, $p = 0.000007$, $r = 0.8188$

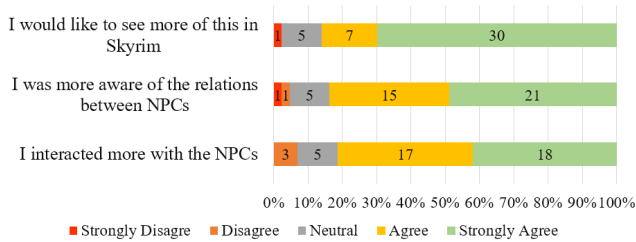
While the player’s perception of the predictability of the NPCs decreased, their understanding of NPCs’ actions increased significantly. Our interpretation of this result is that agents performed actions that the Player was not expecting⁷, however, these actions made sense and were plausible. Additionally almost every participant enjoyed interacting more with the CiF-CK based NPCs than with the “vanilla” ones.

In the final section of the survey we inquired users about their general experience with the mod, its results are shown in Figure 8.

Users enjoyed playing the mod and interacting with its characters. Using CiF-CK adds something new to the NPCs present in Skyrim and that is something players clearly want. We could not anticipate such a great and positive response to this project. While increasing the space of possible interactions we were able to maintain and, in some cases increase, the believability of the NPCs. Users feel the differences between Normal and Social Characters and prefer the latter, the CiF-CK architecture, in their gaming experiences.

⁷Due, probably, to the normally low levels of NPC interactivity and authoring

Fig. 8. Player's agreement level on a 5-point Likert scale
Considering your previous experience with Skyrim, do you agree
with the following statements?



VI. CONCLUSION

This work extended and reimplemented parts of the Comme il Faut architecture which is based on an operationalization of Goffman's Theory. Additionally we took a centralized agent reasoning architecture and added Theory of Mind inspired belief models to increase autonomy, creating the CiF-CK architecture. Its implementation led to the development of "The Elder Scrolls V: Skyrim" mod that was published online.

The mod's reception, popularity and the survey results lead us to conclude that this project was successful in achieving its goals, that is, the addition of the social architecture model did improve the Player experience. Using a Social Simulation architecture we were able to extend the interaction space with the game's NPCs, thus giving the player more interesting choices and, at the same time, obtain more believable characters. Additionally it was successfully deployed to the designer audience with a potentially larger scale impact to the real users of agent architectures.

The CiF-CK architecture should be applicable to any Computer RPG, as long as its engine supports some common features like Quests and controllable NPCs, and is immediately extendable to games like Fallout 3 and 4.

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