Realising an Applied Gaming Eco-system

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D3.6 – Final Storytelling Framework

RAGE – WP3 – D3.6
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Executive Summary

This document presents the Final Release of the project’s storytelling framework, which is composed by two assets. As described in Section 3.5, the purpose of this framework is to facilitate the use of interactive storytelling, with compelling emotional characters, for the development of applied games. More precisely, the framework is meant to aid developers in the creation of game scenarios where both players and autonomous characters are playing an active role in a narrative that unfolds according to their actions.

Following the Deliverable 3.5, this document outlines the changes made to the assets from the time that document was written, up until now. It describes the current state of the assets particularly and the improvements made compared to its previous version. Additionally, we will be providing updated links to the source code of the assets as well as associated demonstrations and documentation.

This document is based on the terms and conditions established in the Grant Agreement (nº 644187) signed by the European Commission and the project coordinator.
1. Introduction

The motivation behind the Storytelling Framework is that good storytelling can bring multiple benefits to serious games that aim to educate or raise awareness. Not only are people more likely to remember what they learned if the content is integrated in the context of a narrative, but also, an emotionally engaging story will greatly motivate players to achieve the intended learning goals of the game. This type of storytelling centers around the ability of players to shape how a story unfolds according to their actions as participants rather than observers. This increases player engagement and encourages them to heavily reflect on the consequences of their choices. However, while the freedom given to the players increases, so does the possible narrative branches the scenario author must deal with and consequently the scenario might quickly become intractable.

In order to avoid that issue and facilitate the creation of interactive storytelling experiences we have created a framework for storytelling that is composed of a set of assets, which follow a character-centered approach. This resulted in two different but highly connected assets: the Role Play Character asset and the Integrated Authoring Tool. The Role Play Character (RPC) asset provides the ability for creation of those virtual characters with a detailed Artificial Intelligence (AI) that makes them autonomous in their reactions and decisions. The Integrated Authoring Tool (IAT) works in conjunction with the first to allow the game developer to establish the different characters used in a game scenario and the range of possible dialogue acts these characters can choose from to interact with the player. The conjunction of these two assets resulted in: the FAItMA Toolkit, a tool that can be used by developers to create, design and manage, both intelligent characters and interactive scenarios.

We haven’t changed the engine behind the assets as such its requirements and extendability hasn’t changed since D3.5:

- The two assets of this framework work as client-side libraries and tools (written in C#).
- They can easily be integrated in the source code of a game that is developed using Unity or other game engines. The examples and demos we provide are all made using Unity.
- Both of the assets work as stand-alone applications that are independent of any game engine.

For the sake of interoperability, we did conduct a successful integration showcase with the Python language, through the use of the pythonnet module (https://pythonnet.github.io). The result is that the compiled versions of the two assets can also be directly used as python modules.

We will now proceed to describe the changes made to each asset between the D3.5 and this final version of the framework. The motivation for the changes are based on the feedback received from the game developer partners. Additionally, we also added new features that expand the capabilities of the assets.
2. Role Play Character

Reasoning about the social context in terms of relationship goals, desires, social status and emotional changes is central to believable behaviour. The Role-Play Character (RPC) asset’s goal is to facilitate the creation of virtual characters that display that socio-emotional behaviour.

As described in D3.5, this socio-emotional behaviour is achieved by integrating the functionality provided by several individual assets into a single asset that manages all the behaviour of a character in a unified perception-action loop. The result is an abstraction of the internal processes of a character that is easy for the game developer to manage and author.

In this Final Release, significant improvements were made to the RPC asset in comparison to its D3.5 version. As mentioned the asset takes into account several different psychology-based human dynamics and social modeling architectures. In this final version we added the Comme il Faut (CiF) social interaction architecture, that models generic interactions, and its consequences, between the Virtual Characters.

The primary knowledge representation element in CiF is the social exchange, a collection of patterns of interaction where the exact performance and social outcome varies based on the personality-specific attributes of the characters involved and the current social state. Using Social Exchanges the developer is able to define a template for an interaction between characters and its effects around them, depending on its result.

The Comme il Faut asset has great synergy with the others. With CiF, developers can easily describe what actions (social exchanges) they want agents to be able to perform. These actions have different starting conditions and consequences, which may come from or even be handled by other assets such as the Social Importance and the Emotional Appraisal asset.

For instance, let’s say we have a scenario where the “Friendship” level between the characters is relevant, and where some actions, such as a “Hug” can only be performed between two agents that are Friends. We can use the Social Importance asset to define what it means to be “Friend” and the Comme il Faut asset can define what the Hug social exchange is. Its starting conditions can be directly linked to the SI’s Friends definition.

Using the CiF and Social Importance models we are able to significantly increase the range of possible scenarios, specially when working together, that the framework can handle, hence, increasing the possibilities for game developers to create applied gameplay for social skill training. This results from increasing the social interaction space of players and game characters.

Once a developer designs a character and inserts him/her in a Social Environment there are several constantly changing status variables that come into play. In order to properly author the scenario, the developer should be able to take those variables into account when designing its characters. FAtiMA Toolkit is now able to represent and compute those variable values using Dynamic Properties and its Calculator Methods.

Dynamic Properties are variables or methods whose values are calculated during runtime. For instance, the mood of a character is constantly changing. Using the “Mood” Dynamic Property, the author can take that variable into account when designing the character’s decision making process, for example, if a mood of character is high, they might want to dance.

The integration works as depicted in Figure 1. The cycle starts when the asset receives as input a list of events that happened in the game environment. These are sent to the Emotional Appraisal asset to determine the character’s new affective state. The list of events is also stored in the agent’s Memory and
propagated into the Social Importance and Comme il Faut components so that these models might influence the agent’s posterior decision making process.

In order to determine what action the Virtual Character wants to perform, the RPC asset consults the Emotional Decision Making (EDM) component. If the EDM of a RPC selects an action it is then sent to the video game. The developer can then use this information in any preferred way. It might map these actions into the video game world or use them as advice for the Player (or don’t use it at all). The whole process is repeated once new events occur in the game world.

Figure 1: How the Role Play Character Asset and its components work together

3. Integrated Authoring Tool

The Integrated Authoring Tool is an asset designed to be the central hub for game developers when creating a new storytelling scenario or adapting existing ones. As we described in D3.5, this asset allows the configuration of the general aspects of the scenario, and provides quick access to the authoring tools of the Role-Play Character asset and other assets from D3.1. This tool provides:

- The ability to define the scenario’s name and to manage the number of characters in the scenario.
- A dialogue editor that allows the developer to specify the dialogue acts that are available for both the player and the characters.

It is important to note that in scenarios created using the Integrated Authoring Tool, the dialogue is not attributed to specific characters but to the scenario’s domain, hence, defining the storytelling affordances of the scenario and its characters. Characters choose from the space of dialogues, defined in the scenario, which sentences they will use according to the situation and their preferences. This means that a line of dialogue is not necessarily only used by a specific character. This facilitates the creation of shared social behaviour.
The Dialogue Editor was significantly improved. While its structure is the same, as described in D3.5, we added a couple of tools to help developers better author their dialogue. Because managing dialogue can quickly get quite complex, game developers usually have their own system of how to create conversations, some including the use of other external tools. In order to improve the its usability, we gave our tool the ability to more easily read dialogue from other sources. This means that the Integrated Authoring Tool can, now, both import and export dialogue editor files from and to common file types, such as Excel and text (".txt") files.

As mentioned, authoring dialogue can be a time-consuming and complex task, as such, it is necessary to regularly check some of its properties, such as consistency and reachability. In order to help developers to debug their dialogue we created a “Check Reachability” option in the Integrated Authoring Tool asset. When users select this option, the asset goes through every line of dialogue and checks if it is reachable or not, in the cases where it is not reachable the tool promptly informs the developer of which particular lines it failed to reach. Using this information developers can detect and fix errors or bugs within their scenarios more efficiently.

We also added an option to use the text-to-speech offered by the Speech I/O asset to automatically record all the dialogues in the available languages, currently English and Portuguese, along with their phonetic information. The Role-Play Character asset can then play these recordings to provide voice to the character with very little latency.

In the new version of the Integrated Authoring Tool we decided to have an agent, i.e. an instance of a role-play character asset, that becomes associated to the player's character. This means that the choices of the player are presented to him/her according to the decisions made by the RPC asset for the player's character. The reason for doing so is the fact that the player is also playing a role of a character that, within the story world, has its own identity, goals and beliefs. As such, having an instance of the RPC asset associated to the player's character allows the author of the scenario to bound the actions of the player to the character that is currently being played. To give an example, if the player is playing a customer service character that is new on the job and does not know the solution of a problem that a customer character is presenting, then the option to give the solution should not be available to the player.

We improved the User Interface of both of the assets described in this document. As the Integrated Authoring tool integrates the Role Play Character asset in its UI, it is important to keep consistency when navigating through all the different tools available to the developer. Moreover the Role Play Character asset itself is defined by multiple different components, as such, we uniformized their UI in order to help users understand each component.

The Integrated Authoring Tool creates a scenario by writing a "*.iat" file with information describing the scenario’s dialogue, its characters, etc. When a game runs a scenario, it reads the specified *.iat file and sets-up the run-time environment. The *.iat file can be altered at any time, either manually (just like one would edit a .txt file) or using the IAT tool. If we change it and inform the game that it needs to reload it the scenario within the game will also change. In other words, it is possible to change the space of dialogue and characters in run-time granting some dynamic adaptability of content to the game.
Figure 2: Integrated Authoring Tool with a Role Play Character loaded and its “Comme il Faut” asset on display.

Figure 3: Integrated Authoring Tool with its Dialogue Editor View selected.
4. Integration Showcase

In D3.5 we developed a small prototype that demonstrated the capabilities of this framework. Our prototype was based on the Space Modules game where the player must also solve a technical problem of a virtual customer. This virtual customer is controlled by an instance of the Role-Play Character asset with a specific configuration for its decision-making processes and emotional appraisal.

Throughout this past year we have continued working on this prototype. This work allowed us to expand the prototype’s range of uses through an increase in platform compatibility, user support, and more flexible users scenario. The Storytelling Framework is now compatible with a number of different platforms such as Android phones, IOS devices and WebGL so that it can run directly on a modern browser, without requiring installation.

The desire to use the prototype in research studies led to the following development:

Storytelling Framework VR Demo

With the recent rise of popularity of new technologies such as Virtual Reality and Augmented Reality, players are more immersed than ever within virtual worlds and virtual characters. The chance for VR to enable the “presence” of a user, in other words, to make users feel as if they are actually reacting to the environment around them is unprecedented. These new technologies allow player immersion to reach a completely different level but they also create completely new expectations in terms of experiences.

In order to demonstrate what the Storytelling Framework can do, we decided to create a Virtual Reality gameplay experience. This experience makes full use of both the Integrated Authoring Tool and the Role Play Character assets. It also makes use of other RAGE-developed assets, such as L2F’s “Speech I/O” and Behaviour Mark-up Language (BML) Realizer, showing players and developers the synergy between the tools developed throughout the project.

In order to effectively design a place where players could properly interact with characters and scenarios built with the Storytelling Framework, we needed to set in place what type of interaction it would be and what type of relationship players would have with the characters. We chose to simulate a police
interrogation. There are two main reasons behind this decision: First, one of the RAGE’s partners is Escola da Polícia Judiciária (Ministério da Justiça, PT), as such we could ask them for feedback and scenarios. Secondly, a police interrogation scenario can effectively test and assert the quality of our asset as it requires characters to display emotions and players to be focused on their decisions.

The demo is set in an interrogation room where users play the part of a Police Interrogator and interact with a Suspect, that is a Role Play Character. The player’s objective is to obtain the most information about the suspect they can. In order to interact with the subject, players can select questions from a wide array of possible choices that are displayed in a virtual computer screen as seen in Figure 4. After selecting a question the virtual suspect will answer to it, using Text to Speech, according to its mood and its emotions. The questions are sorted through various different topics such as “Marriage”, “Children”, “Work” among others. These questions and answers are managed through the Integrated Authoring Tool Asset’s Dialogue Manager. Storytelling Framework VR Demo is compatible with most Virtual Reality headsets, and it uses the Unity Game Engine.

**Space Modules Inc**

Playgen (UK) has been developing a videogame where the player takes on the role of a customer service representative for a spaceship part manufacturer: “Space Modules Inc”. Using the Storytelling Framework, each customer has a unique emotional profile and provides a new challenge to the player in each level of the game. Players must learn how to manage intense emotions and how to respond to customers in a professional manner in the best way, as seen in Figure 5. In order to effectively manage both Players’ and NPCs’ answers Playgen makes use of both the Integrated Authoring Tool Asset and its Role Play Character Asset component.
Sports Team Manager

Playgen has also been developing a videogame where the player takes on the role of a Team Manager. Players are tasked with managing a sailing team, players need to set up optimal line-ups for every race. To achieve this, they will need to communicate with virtual characters in order to resolve conflict scenarios when they occur and discover attributes and relationships that will affect how the team performs. It gameplay can be seen in Figure 6.

Sports Team Manager also makes full use of the Storytelling Framework in order to manage its virtual characters and scenarios.

5. Conclusion

In this document, we discussed the final release of our storytelling framework and the assets within it. The first one, the Role-Play Character, is responsible for aggregating multiple assets into a tool that manages all the AI processes of a character. These include the ability to generate emotions in response to events, express those emotions in the character’s embodiment, and make decisions according to the character’s emotional state and according to existing social norms. The second asset of the framework, the Integrated Authoring Tool, is responsible for managing the characters in the scenario as well as defining the range of possible dialogue options available for the characters and the player.

The assets were used in a number of different games developed by PlayGen, “Space Modules Inc.” and in “Sport Team Manager”. Additionally, in order to effectively test the proposed framework, a prototype inspired by one of the applied games of the project was developed. In this final release we continued to work on the prototype and it is now available as a Virtual Reality Experience. The prototype provides a good example of what the Storytelling Framework can do and how different RAGE assets can successfully work together.

We have been careful to make sure that the assets presented in the report have been integrated in both running demos and code samples. The repositories also provide detailed descriptions on how to use each
asset and how to incorporate it into another project. This facilitates the integration, by game developers, of the tools and eases the "learning curve" when working with the Storytelling Framework.