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D3.1 – First Bundle of Core Social Agency Assets

RAGE – WP3 – D3.1

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1 EXECUTIVE SUMMARY

This deliverable presents and describes the first delivery of assets that are part of the core social agency bundle. In total, the bundle includes 16 assets, divided into 4 main categories. Each category is related to a type of challenge that developers of applied games are typically faced with and the aim of the included assets is to provide solutions to those challenges.

The main goal of this document is to provide the reader with a description for each included asset, accompanied by links to their source code, distributable versions, demonstrations and documentation. A short discussion of what are the future steps for each asset is also given.

The primary audience for the contents of this deliverable are the game developers, both inside and outside of the project, which can use this document as an official list of the current social agency assets and their associated resources. Note that the information about which RAGE use cases are using which of these assets is described in Deliverable 4.2.

This document is based on the terms and conditions established in the Grant Agreement (n° 644187) signed by the European Commission and the project coordinator.

2 INTRODUCTION

Creating pedagogical games that emphasise social interaction is a task that raises difficult challenges for game developers. The assets that are part of this bundle were designed to provide tools for addressing these challenges adequately. The first challenge that is considered is the creation of non-player characters that act in a believable manner, responding emotionally to events as well as acting in accordance to the existing social norms. The second challenge is the creation of a character's embodiment that is believable in its non-verbal signals. The third challenge pertains to the use of natural language as a way to interact with the game. Finally, the fourth challenge concerns the adaptation and personalization of the game experience.

The assets included in this bundle are divided into four categories, one for each of the aforementioned challenges. They are the result of a selection process in which the interests of asset developers had to face the needs of game developers for their use cases. During this process, the following milestones were achieved: (1) A high-level description for all asset proposals was written, which focused on the potential value of the asset; (2) A common quality assurance checklist was defined in collaboration with Work Package 2 to guide the development process; (3) Based on their potential, game developers and use case owners decided which assets they were interested for which use cases (assets that were not selected were put on hold or dropped); (4) The first release of the selected assets was delivered to game developers.

Concerning their architecture, the bundle contains both client-side and server-side assets. In both cases, the development of the assets took into consideration the requirements put forth by the overall asset architecture defined in Work Package 1. Finally, it is important to mention that besides from the source code and distributable binaries, each asset includes a documentation of their API and a standalone demo that exemplifies its usefulness.

3 DECISION-MAKING AND SOCIO-EMOTIONAL BEHAVIOUR ASSETS

The assets in this first category facilitate the creation of Non-Player Characters that have a dynamic model of emotions as well as a model of implicit socio-cultural norms that govern human interaction. These computational models can help to achieve a behaviour for the non-player characters that is more believable and engaging, particularly when interacting socially with human players.

The development for these assets follows the previous work done in the FATiMA Modular agent architecture [1], which has been successfully used in the past to create serious games such as FearNot! [2] or Traveller [3]. In the context of the RAGE project, the assets in this category were initially developed by porting the existing code of FATiMA Modular that was written in Java to the C# language. Beyond porting the code, several important design decisions were made to facilitate the adoption of the technology by game developers. One such decision was to make the assets work as client-side libraries that can be imported and used directly in the game source code. Previously, FATiMA worked as a stand-alone application that communicated via a TCP/IP protocol. This caused difficulties in debugging as well as restricted the ability for the game to be deployed as a mobile or a web application. These issues do not exist with the new approach as the assets can always be used as long as the game engine can import C# DLLs. Additionally, the assets were made compliant with the general asset architecture that was defined in WP1. Finally, to facilitate the authoring process, an auxiliary authoring tool with a graphical user interface was developed for all three assets.

[1] Dias, J., Mascarenhas, S., & Paiva, A. (2014). *Fatima modular: Towards an agent architecture with a generic appraisal framework*. In *Emotion Modeling* (pp. 44-56). Springer International Publishing.

[2] Paiva, Ana, et al. "Caring for agents and agents that care: Building empathic relations with synthetic agents." *Proceedings of the Third International Joint Conference on Autonomous Agents and Multiagent Systems-Volume 1*. IEEE Computer Society, 2004.

[3] Degens, Nick, et al. "Traveller–intercultural training with intelligent agents for young adults." *Proceedings of the 8th international conference on foundations of digital games 2013*. 2013.

3.1 Emotional Appraisal

This asset manages the emotional state of a character in response to the events that occur during the game. It provides an implementation of an appraisal mechanism that is based on the OCC theory of human emotions. Previous research has shown that game characters should have believable emotional responses to give the illusion of life. For applied games that rely heavily on social interaction, it quickly becomes impractical to manually script all the emotional reactions of each character for each possible event. The Emotion Appraisal asset tackles this issue by allowing game developers to create general profiles of how characters respond emotionally in their games. They can test and configure these profiles outside of the game and they can naturally switch between profiles without having to recompile the game source code.

For this first release, the development of the asset was focused on implementing the following core functionality: (1) A dynamic emotional state that is comprised of an overall mood and a list of emotions; (2) A knowledge base that maintains a set of beliefs that are expressed as logical properties; (3) An autobiographical memory that registers the events that happens in the game coupled with the strongest emotion associated to that event; (4) A list of appraisal rules that determine how events are judged from an emotional perspective which then leads to changes in the affective state.

In its next release, the asset will include a theory of mind mechanism that is able to simulate and make predictions about the emotional state of the user (and other characters) as well as an empathy model that will enable the character to feel empathic emotions.

Links

- Repository:
 - <https://github.com/GAIPS-INESC-ID/FAtiMA-Toolkit>
- Download (Source Code):
 - https://github.com/GAIPS-INESC-ID/FAtiMA-Toolkit/releases/tag/Release1_0
- Download (DLLs + Authoring Tool):
 - <https://gaips.tagus.ist.utl.pt/~smascarenhas/rage/emotional-appraisal-release-1-0.zip>
- Documentation:
 - <https://github.com/GAIPS-INESC-ID/FAtiMA-Toolkit/blob/master/Documentation/EA-Documentation.pdf>
- Online Demo:
 - <http://gaips.tagus.ist.utl.pt/~smascarenhas/rage/demo/index.html>
- Download Demo (Source):
 - <http://gaips.tagus.ist.utl.pt/~smascarenhas/rage/demo/demo-unity.zip>

3.2 Emotional Decision Making

The Emotional Decision Making asset is used for the creation of non-player characters whose decisions are impacted by their emotional state. To achieve this, the asset offers a logical reasoner that the game developer can use to define the rules for the character's decision making process. These rules can depend not only on the characters' emotions but also on the occurrence of certain previous events and the belief in certain properties about the world. Similar to the Emotional Appraisal asset, the rules in the Emotion Decision Making are created and managed outside of the game code, which facilitates the testing of different alternatives for the characters' decisions as well as customization.

For this release, the following main functionality was implemented: (1) Integration with the Emotional Appraisal Asset allowing to define action rules that are triggered by a particular affective state; (2) A reactive decision-making layer that checks for the activation of a set of logical conditions in each action and filters them according to a specified priority.

In the next release, a deliberative layer will be added that takes into account the expected emotional impact of each possible decision.

Links

- Repository:
 - <https://github.com/GAIPS-INESC-ID/FAtiMA-Toolkit>
- Download (Source Code):
 - https://github.com/GAIPS-INESC-ID/FAtiMA-Toolkit/releases/tag/Release1_0
- Download (DLLs + Authoring Tool):
 - <https://gaips.tagus.ist.utl.pt/~smascarenhas/rage/emotional-decision-making-release-1-0.zip>
- Documentation:
 - <https://github.com/GAIPS-INESC-ID/FAtiMA-Toolkit/blob/master/Documentation/EDM-Documentation.pdf>
- Online Demo:
 - <http://gaips.tagus.ist.utl.pt/~smascarenhas/rage/demo/index.html>
- Download Demo (Source):
 - <http://gaips.tagus.ist.utl.pt/~smascarenhas/rage/demo/demo-unity.zip>

3.3 Social Importance Dynamics

This asset facilitates the creation of intelligent characters that behave appropriately according to a configurable set of established socio-cultural rules of behaviour. Game developers can use this asset to be able to create and shape the socio-cultural rules of their applied game experience. This allows for applied games to adapt to audiences from different cultural backgrounds. For instance, there are social conventions that characters should be able to follow such as introducing themselves in the beginning of a conversation or saying goodbye at the end. Many of these conventions are tied to the social standing or social role of the other person. As an example, the appropriate way to greet a friend is different from the appropriate way to greet a customer. Also, it is appropriate to ask favours to a friend and give orders to employees but not the other way around. This asset will minimize the effort to add these established social conventions to an existing game scenario and have characters acting in accordance to them. The asset also adds the ability of the characters to automatically detect and respond negatively to the player whenever he or she behaves inappropriately. Originally, we planned to have three distinct assets covering different aspects of social behaviour, one for modelling social reality, another to manage interpersonal relationships and another for modelling social motivation. Given that these aspects are very intertwined, it was later decided that they would be integrated together in the Social Importance asset.

The following functionality was implemented for this first release: (1) A rule-based model that allows the agent to attribute social importance to others and infer its own importance; (2) A deliberative decision-making model that selects normative actions that are expected by others in certain contexts (e.g. greetings) and filters out actions that the agent does not have enough social importance to perform them (without being considered socially inappropriate). Currently, the asset uses a numerical approach to quantify the social importance granted by certain relational aspects (e.g. being a friend or being the boss). We are currently investigating the use of a categorical approach instead, which can greatly facilitate the authoring process.

Links

- Repository:
 - <https://github.com/GAIPS-INESC-ID/FAtiMA-Toolkit>
- Download (Source Code):
 - https://github.com/GAIPS-INESC-ID/FAtiMA-Toolkit/releases/tag/Release1_0
- Download (DLLs + Authoring Tool):
 - <https://gaips.tagus.ist.utl.pt/~smascarenhas/rage/social-importance-release-1-0.zip>
- Documentation:
 - <https://github.com/GAIPS-INESC-ID/FAtiMA-Toolkit/blob/master/Documentation/SI-Documentation.pdf>
- Online Demo:
 - <http://gaips.tagus.ist.utl.pt/~smascarenhas/rage/demo/index.html>
- Download Demo (Source):
 - <http://gaips.tagus.ist.utl.pt/~smascarenhas/rage/demo-unity.zip>

4 EMBODIMENT AND PHYSICAL INTERACTION ASSETS

This category contains a single asset that is responsible to facilitate the creation of a flexible embodiment for virtual characters in applied games. There is a synergy between this asset and the ones from the previous category as the embodiment provided is able to support the display of the various generated emotional states.

4.1 *Virtual Human Controller*

Virtual Human Controller generates the expressive behavior of the character including lip-synchronized speech animation, gestures, facial expressions and gaze. It takes as input Behavior Mark-up Language (BML) commands (e.g. speak, smile and look at) to control the behavior of the virtual human. It blends these different channels of animations and generates the final animation as output. The asset provides a ready-to-use platform for 3D character-based games and builds on top of a well-known game engine (Unity 3D). It uses an off-the-shelf text-to-speech (CereVoice) library. As Unity is multi-platform, it can be deployed on different platforms including Web and mobile applications.

Links

- Repository:
 - https://svn.science.uu.nl/repos/sci.yumak001.Virtual_Human_Controller
- Documentation:
 - https://rage.ou.nl/filedepot_download/370/552
- Executable Demo:
 - https://svn.science.uu.nl/repos/sci.yumak001.Virtual_Human_Controller
- Demo (Source Code):
 - https://svn.science.uu.nl/repos/sci.yumak001.Virtual_Human_Controller
- Demo (Video):
 - https://www.dropbox.com/sh/2ejasnixlv7utrp/AABD07mdbr0717_fHXIkWfQRa?dl=0&preview=Interactive+Virtual+Human+Sara.mp4

- User documentation
 - <http://readerbench.com/docs/semantic-models/manual>
- Design
 - <http://readerbench.com/docs/semantic-models/sdd>

5.2 *ReaderBench - Automated Essay Grading*

Automated evaluation of textual complexity represents a key focus for the linguistic research field as it emphasizes the evolution of technology's facilitator role in educational processes. From a tutor perspective, the task of identifying accessible materials plays a crucial role in the learning process since inadequate texts, either too simple or too difficult, can cause learners to quickly lose interest. Therefore, we have introduced a multi-dimensional analysis of textual complexity, covering a multitude of factors integrating classic readability formulas, surface metrics derived from automatic essay grading techniques, syntax indices, as well as semantics and discourse.

Essay analysis and grading plays a crucial role in the learning process because it is an indicator for a tutor about the progress of the student and for the latter because it provides a valuable feedback. One of the main features of a well written essay is to have a complexity tailored to a specific destination. Therefore, we have introduced a multi-dimensional analysis of textual complexity, covering a multitude of factors integrating classic readability formulas, surface metrics derived from automatic essay grading techniques, syntax indices, as well as semantics and discourse that are afterwards combined through the use of specific supervised classifiers (e.g., Support Vector Machines, Discriminant Function Analysis). In the end, each factor can be correlated to learners' comprehension traces, therefore creating a clearer perspective in terms of measurements impacting the perceived difficulty of a given text.

In a nutshell, the proposed evaluation model combines statistical factors and traditional readability metrics with information theory, specific information retrieval techniques, probabilistic parsers, Latent Semantic Analysis and Latent Dirichlet Allocation semantic models for best-matching all components of the analysis. This facilitates a wide range of educational scenarios covering: automated evaluation of summaries with regards to comprehension prediction, assessment of cover letters in terms of language adequacy, as well as potential recommendations for improving one's writing style.

TEXTUAL COMPLEXITY

READABILITY FORMULAS (EN)

1.769	RdblyFlesch
19.868	RdblyFog
16.767	RdblyKincaid

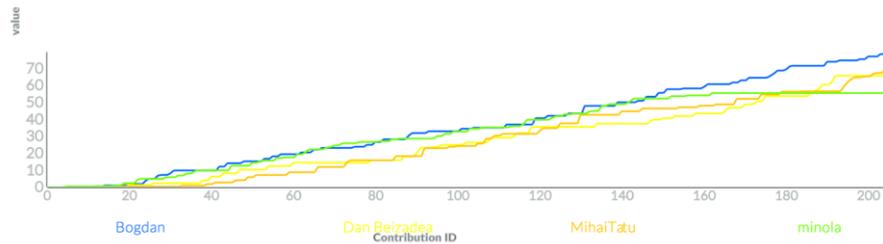
SURFACE FACTORS (AVERAGE LENGTHS IN CHARACTERS)

417.667	AvgBILen
125.3	AvgSenLen
5.594	AvgWdLen
2.83	WdLettStdDev

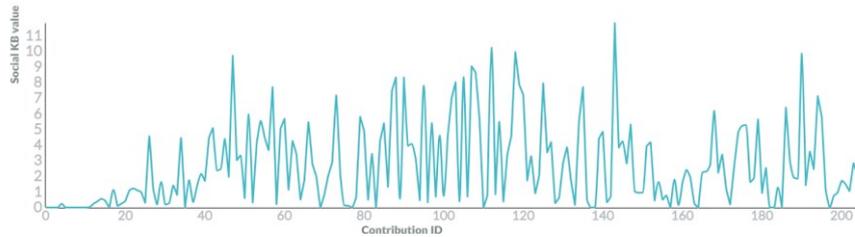
SURFACE FACTORS (STATISTICS)

SURFACE FACTORS (ENTROPY)

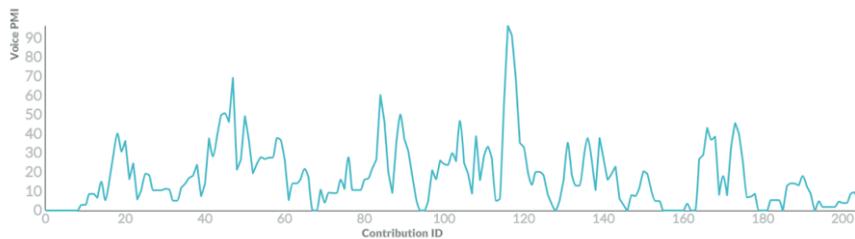
PARTICIPANT EVOLUTION



COLLABORATION - SOCIAL KNOWLEDGE BUILDING



COLLABORATION - VOICE OVERLAP



Current status

- The validation of new automated models used to evaluate participation and collaboration in CACL conversation (e.g., chats, forums, blogs)

Publications

- Trausan-Matu, S., & Dascalu, M. (2015). Visualization of Polyphonic Voices Inter-animation in CACL Chats. *Revista Romana de Interactiune Om-Calculator*, 8(4), 305–322.
- Nistor, N., Dascalu, M., Stavarache, L. L., Tarnai, C., & Trausan-Matu, S. (2015). Predicting Newcomer Integration in Online Knowledge Communities by Automated Dialog Analysis. In Y. Li, M. Chang, M. Kravcik, E. Popescu, R. Huang, Kinshuk & N.-S. Chen (Eds.), *State-of-the-Art and Future Directions of Smart Learning* (Vol. Lecture Notes in Educational Technology, pp. 13–17). Berlin, Germany: Springer-Verlag Singapur
- Nistor, N., Dascalu, M., Stavarache, L. L., Serafin, Y., & Trausan-Matu, S. (2015). Informal Learning in Online Knowledge Communities: Predicting Community Response to Visitor Inquiries. In G. Conole, T. Klobucar, C. Rensing, J. Konert & É. Lavoué (Eds.), *10th European Conf. on Technology Enhanced Learning* (pp. 447–452). Toledo, Spain: Springer.
- Dascalu, M., Trausan-Matu, S., McNamara, D.S., & Dessus, P. (2015). ReaderBench – Automated Evaluation of Collaboration based on Cohesion and Dialogism. *International Journal of Computer-Supported Collaborative Learning*, 10(4), 395–423. doi: 10.1007/s11412-015-9226-y

Links

- Repository:
 - <https://git.readerbench.com/ReaderBench/ReaderBench>
- Release:
 - <https://git.readerbench.com/ReaderBench/ReaderBench/tags>

- Online demo
<http://readerbench.com/demo/cscl>
- User documentation
<http://readerbench.com/docs/cscl/manual>
- Design
<http://readerbench.com/docs/cscl/sdd>

5.4 *ReaderBench* - Automated Identification of Reading Strategies

The use of reading strategies is widely recognized as a crucial determinant of reading comprehension. These strategies can be elicited through self-explanations. The automatically identified strategies within *ReaderBench* comprise of monitoring, causality, bridging, paraphrase and elaboration. Therefore, specific strategies used by learners become reliable predictors of comprehension; the usage of textual complexity indices also improves the overall accuracy.

READING STRATEGIES

Je crois qu' il y a **donc** la **famille** de matilda ben ils sont en train de **manger** et soudain y a quelqu' un qui entre en disant **salut salut salut** apr s ils croient que c' taient des **voleurs** **alors** ils **prennent** des armes et ils vont vers le voleur . y en a qui croient que c' est des **voleurs** mais le p re il croit pas . et la **femme** et matilda ils croient elles croient que c' est des **voleurs** . et apr s matilda elle **dit** que c' est un fant me et qu' il **hante** la salle . et apr s ils **sortent** tous du **salon** .

Bridged elements:

elle dit à son mari « il y a quelqu' un dans la maison » - Cohesion: 0.642;

sa femme lui dit : « alors, tu te décides - Cohesion: 0.535;

matilda prit le couteau avec lequel elle mangeait - Cohesion: 0.713;

c'est alors qu'elle sortit du manteau de la cheminée le perroquet de leur copain arthur - Cohesion: 0.542;

7 Paraphrase

2 Causality

4 Text based inferences

6 Bridging

0 Inferred Knowledge

1 Metacognition

Current status

- Implementation of new heuristics for the identification of reading strategies employed by learners

Links

- Sources:
 - <https://git.readerbench.com/ReaderBench/ReaderBench>
- Release:
 - <https://git.readerbench.com/ReaderBench/ReaderBench/tags>
- Online demo:
 - <http://readerbench.com/demo/self-explanation>
- User documentation:
 - <http://readerbench.com/docs/reading-strategies/manual>
- Design:
 - <http://readerbench.com/docs/reading-strategies/sdd>

5.5 Communication Scenario Editor

The Communication scenario editor (called scenario editor from now on) is a tool in which a communication expert iteratively develops a communication scenario as a directed acyclic graph of steps, and specifies the respective scores and feedback per step. The editor balances usability for a non-programming (communications) expert and expressiveness of the constructs in which a scenario can be expressed. Besides the standard sequence, choice, and conditional options, the editor offers interleaving and premature endings. Interleaving is particularly useful when students have to perform multiple (sub)tasks, but the order in which these tasks are performed is not important. Premature endings enable a player to skip the following steps in a sequence. Interleaving and premature endings add expressiveness to the editor, and give the author the possibility to obtain a high-level view of a scenario. Other important features of the editor are the possibility to specify learning goals for a scenario, and to specify the emotional effect and the score on (some of) the learning goals of the choice of a player for a particular statement. None of the existing editors on for example the Unity store, such as Dialogueur, or Simple Dialogue Engine Asset, combines the features of the scenario editor. The editor is implemented in JavaScript and runs in a web-browser. The output of the editor, a dialogue, is stored as an XML file. To use a scenario in a game, use the step-based competency assessment asset.

Links

- Repository:
 - <https://github.com/UURAGE/ScenarioEditor>
- Documentation:
 - <https://github.com/UURAGE/ScenarioEditor/blob/master/doc/SDD%20Scenario%20Editor%20v3.pdf>
- Demo (Video):
 - <https://www.youtube.com/watch?v=eaLbIvbmPOU&feature=youtu.be>
- Interactive Demo:
 - <http://www.communicategame.nl/UURAGE/ScenarioEditor/demo/>

5.6 Speech I/O

This asset is composed of Natural Language Processing (NLP) components tailored for integration in games. All components are available online, through an Internet connection, and rely on services provided by a computing framework at L2F/INESC-ID. Additionally, some components are also available for offline usage.

Asset integration in a game is achieved with simple networking principles, as each component follows a client/server architecture. For components featuring the offline usage mode, this architecture allows a component's server to run on the local machine or on a remote server providing the service to several clients. Component usage in online mode only requires integration of clients in the game development framework, since the server part is only accessed/managed remotely (through HTTP requests).

As most of our components are based on Machine Learning (ML), language coverage is limited by availability of training data, thus variable across components, with some supporting multiple languages while others only support Portuguese or English.

The asset is fully functional and ready to use by end developers, for online usages (relying on remote services, which require an Internet connection) and with the Unity game engine (code guidelines not yet implemented).

Some of the asset's components are still being improved, even when using the online mode. Namely, speech to text is not complete and emotion detection from text is not yet validated.

Links

- Repository:
 - <https://bitbucket.org/L2F-INESCID/speechio>
- Documentation:
 - <https://docs.google.com/document/d/1gqFETDG10eEo444s14ENEFmdHufEofDfHnGnIEWt3a4/edit?usp=sharing>
- Online Demo:
 - <http://www.l2f.inesc-id.pt/~pfialho/rage/>

6 GAME BALANCING AND PERSONALIZED LEARNING

ASSETS

The assets in this last category provide both on-line and off-line mechanisms to adapt the game experience to each individual player in order to maximize learning outcomes.

6.1 *Adaptation and Assessment (TwoA) Asset*

This asset enables a real-time automatic adaptation of game difficulty to player's expertise level. The adaptation algorithm is a scientifically well-validated and practically proven method that is being successfully used by its original developers (Oefenweb, <https://www.oefenweb.nl/>) in web-based serious games (e.g., <https://www.mathsgarden.com/>). The asset provides a portable and highly interoperable implementation of the publicly available version of the algorithm.

The adaptation algorithm makes use of a stealth assessment algorithm that assigns difficulty ratings and expertise ratings to players and game modules respectively. The asset tracks changes in these ratings allowing assessment of players' learning progress either by players themselves or by instructors. Therefore, the asset can be used for stealth assessment as well as for adaptation.

The asset is lightweight with minimal requirements for integrating with a game and minimal impact on the game performance. The asset is also agnostic to the game content requiring only basic performance metrics with no explicit domain knowledge.

An early version of the asset is available at Github (refer to links below). Software consists of two components: (1) a core adaptation component to be integrated with a game and (2) an exemplar standalone data visualization/analysis component. Manuals on using both components are available within the packages.

Links

- Repository:
 - <https://github.com/rageappliedgame/HatAsset>
- Authoring Tool (Source Code):
 - <https://github.com/rageappliedgame/HATWidget>
- Documentation:
 - <http://rage.deploy.ftk.de/?id=38&content=68>
- Executable Demo:
 - <https://github.com/E-Nyamsuren/rage-wp3-t3.4-hat>

6.2 *Competence-based Adaptation Asset*

The goal of this Competence-based Adaptation Asset is to identify competences and game situations that are meaningful to be tackled next. If competences have been assessed before, the current competence state of a player is available. Based on this state, next competences to be acquired and related game situations can be recommended. The main value of this asset is to recommend next game situations or competences to learn that fit to the current competence state of a player.

The main functionality of this asset is to recommend game situations fitting to the current competence state of the player. The competence state is based on a domain model that structures the competences in a prerequisite relation. In addition, the domain model includes information of the events and situations of a game and relates them to the competences. Events

and completion state of game situations speak either for or against the possession of a competence. Based on this information the competence state can be calculated by the Competence Assessment Asset. Based on this information the Competence-based Adaptation Asset can recommend which competences should be attained next and thus calculate which game situation should be performed next.

In this release the included functionality consists in the recommendation of competences and game situations based on previously assessed competence state. The calculation is done upon a previously created motivational model.

In the next release the recommendations are also sent to the tracker, so that a teacher can review the adaptations made to the player in the light of what the player actually did.

Links

- Repository:
 - <https://github.com/RAGE-TUGraz/CompetenceBasedAssets>
- Download (DLLs):
 - <http://css-kti.tugraz.at/projects/rage/assets/software/CompetenceBasedAdaptationAsset.zip>
- Documentation:
 - <http://css-kti.tugraz.at/projects/rage/assets/factsheets/FactSheet-Competence-basedAdaptationAsset.pdf>
 - <http://css-kti.tugraz.at/projects/rage/assets/designdocuments/DesignDocument-Competence-basedAdaptationAsset.pdf>

6.3 Motivation-based Adaptation Asset

This asset will enable adapting a game to an individual player's current motivational state identified through the motivation assessment asset. Based on a menu of adaptation types and adaptation rules defined in the asset and made available in the game, motivational interventions within a game situation (e.g. encouraging feedback) or adaptations for the next game situation (e.g. change of difficulty) are triggered.

The game can adapt to a player's motivational state (assessed through the Motivation Assessment Asset) in terms of feedback and game play. Motivation to learn and thus, interest to play the applied game is supported. Interventions to maintain motivation can be provided during gaming experience only to those players, for which actually a lack or decrease of motivation is assumed.

In this release the included functionality consists in the recommendation of displaying encouraging messages to the player based on the previously assessed motivational state. The calculation is done upon a previously created motivational model.

In the next release the recommendations are also sent to the tracker, so that a teacher can review the hints made to the player in the light of the motivational state of the player.

Links

- Repository:
 - <https://github.com/RAGE-TUGraz/MotivationBasedAssets>
- Download (DLLs):
 - <http://css-kti.tugraz.at/projects/rage/assets/software/MotivationBasedAdaptationAsset.zip>
- Documentation:
 - <http://css-kti.tugraz.at/projects/rage/assets/factsheets/FactSheet-Motivation-basedAdaptationAsset.pdf>

- <http://css-kti.tugraz.at/projects/rage/assets/designdocuments/DesignDocument-Motivation-basedAdaptationAsset.pdf>

6.4 *Player Profiling Asset*

This asset allows the adaptation of a game tailored to an individual player's characteristics before the start of the game – e.g. game pace or game elements. This is realised as initial adaption when a player enters a game for the first time based on the responses of the player to short questionnaires on relevant characteristics and personality traits (e.g. sensation seeking, goal orientation). The Player Profiling Asset provides such a questionnaire on its Web interface and delivers derived values that define the game adaptation. The authoring tool of the asset allows to modify existing questionnaires and to create new questionnaires.

Learners differ in many different characteristics – their personality traits and preferences. The Player Profiling Asset takes into account these characteristics and tailors (applied) games to them. This helps creating more enjoyable and motivating game experiences and, in the end, supports learning. Based on personality questionnaires these characteristics are assessed and translated in a set of values that are used by the game for the pre-adaptation.

In this release the included functionality consists in the assessment of personality traits through a questionnaire and the calculation of values based on this assessment that are provided to the game. The questionnaire and calculation method can be created in the authoring tool.

In the next release the calculated values are also sent to the tracker, so that a teacher can review these initial values.

Links

- Repository:
 - <https://github.com/RAGE-TUGraz/PlayerProfilingAsset>
- Download (DLLs):
 - <http://css-kti.tugraz.at/projects/rage/assets/software/PlayerProfilingAsset.zip>
- Documentation:
 - <http://css-kti.tugraz.at/projects/rage/assets/factsheets/FactSheet-PlayerProfilingAsset.pdf>
 - <http://css-kti.tugraz.at/projects/rage/assets/designdocuments/DesignDocument-PlayerProfilingAsset.pdf>

6.5 *Cognitive Intervention Asset*

This asset enables personalisation to an individual player by specifying and providing interventions (in form of messages or feedback during gaming) that aim at supporting learning – e.g. by prompting reflection on the task goals or by conveying facts. A concrete intervention is triggered based on rules using log data of the player's activities. The rules are defined in the authoring tool of the asset. In principle, wanted and unwanted behavior can be modeled and related interventions if such modeled behavior occurs. This asset enables personalisation to an individual player by specifying and providing interventions (in form of messages or feedback during gaming) that aim at supporting learning – e.g. by prompting reflection on the task goals or by conveying facts. A concrete intervention is triggered based on rules using log data of the player's activities. The rules are defined in the authoring tool of the asset. In principle, wanted and unwanted behavior can be modeled and related interventions if such modeled behavior occurs.

Learners sometimes get stuck on a problem/task or get off from the intended/desired path while playing an applied game. This may lead to difficulties or failure in the achievement of learning objectives. The goal of the Cognitive Intervention Asset is to support players by providing tailored interventions (in form of messages or feedback during game situations) that foster learners' reflection and conscious thinking. The interventions are triggered based on simple rules using basic interaction data (without separate assessment).

In this release the included functionality consists in the monitoring of the players' behaviour and the feedback if the learner did some wrong or achieved something. The underlying model can be created in the authoring tool.

In the next release the provided feedback to player will also be delivered to the tracker, so that a teacher can review that.

Links

- Repository:
 - <https://github.com/RAGE-TUGraz/CognitiveInterventionAsset/>
- Download (DLLs):
 - <http://css-kti.tugraz.at/projects/rage/assets/software/CognitiveInterventionAsset.zip>
- Documentation:
 - <http://css-kti.tugraz.at/projects/rage/assets/factsheets/FactSheet-CognitiveInterventionAsset.pdf>
 - <http://css-kti.tugraz.at/projects/rage/assets/designdocuments/DesignDocument-CognitiveInterventionAsset.pdf>

6.6 Player-Centric Rule-and-Pattern-Based Adaptation

The Player-centric rule-and-pattern-based adaptation asset uses metrics of player's performance, emotional status and/or playing style for realization of dynamical adaptation of various game features such as adaptation of player-driven game tasks and/or game assistance, dynamic adjustment of task difficulty, and/or adjustment of properties of audio-visual content and effects. The asset receives as input registration requests of player-centric metrics together with simple formal definitions of rules and patterns of variation of these metrics during the play time or their features such as mean, deviation and moving average within a desired time window. Next, it receives values of registered metrics and checks each incoming metric value for occurrence of a rule or a pattern defined for the metric or its feature. In case of finding such an occurrence, the asset fires a triggering event about this rule or pattern and executes its event handler, which is to be defined by the game developer depending on his/her goal to adapt specific game feature(s).

The functionality implemented in the first version is the following:

- Registering/Unregistering player-centric metrics;
- Defining adaptation triggering rules and patterns;
- Setting global time and the moving average time window for the asset;
- Finding occurrence of a rule or a pattern defined for a metric.

Links

- Repository:
 - <https://github.com/ddessy/PlayerCentricRuleBasedAdaptation>
- Download (Source Code):
 - <https://github.com/ddessy/PlayerCentricRuleBasedAdaptation/tree/master/PlayerCentricRuleBasedAdaptationSource>
- Download (DLLs):
 - <https://github.com/ddessy/PlayerCentricRuleBasedAdaptation/tree/master/PlayerCentricRuleBasedAdaptationBin>
- Documentation:
 - <https://github.com/ddessy/PlayerCentricRuleBasedAdaptation/Docs>
- Demo (video):
 - <https://www.youtube.com/watch?v=c46blt9yj9c>
- Demo (source):
 - <https://github.com/ddessy/PlayerCentricRuleBasedAdaptation/tree/master/UnityDemoCode>

7 CONCLUSION

This document provides a description of all the assets that were included in the first bundle of core social agency assets. These assets were created to facilitate the creation of pedagogical games that can greatly benefit from believable social interactions and personalized adaptation. Game developers selected these assets based on their added value for specific use cases in the project. It is expected that their feedback will greatly inform how these assets can be further improved for the final bundle.