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Authoring Emotion

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1. Chapter short description

It is wide accepted that emotion "guides perception, increases the selectivity of attention, helps determine the content of working memory, in sum, it motivate, organize and sustain particular sets of behaviours" (Izard e Ackerman, 2000:254). Therefore, emotion is a very powerful strategy to achieve the attention and the information retention of other people with whom we communicate. In fields as Entertainment, it is important for the creation of engagement with fiction because it strongly depends of the interest and attention of the viewers (Plantinga, 1999). Also in fields as Education, Health and Security, in which it is important to have people alertness and memorising new inputs, it is also highly relevant to catch attention of users. Examples as teaching how to follow health prescriptions; teaching difficult/boring matters; or teaching how we must react in emergencies demonstrates the need to have emotion authoring tools accessible and easy to use by people with little technology skills.

In this chapter, we will discuss the development of a plug-in for two authoring tools: Inscape[1] and Teatrix[2]. The plug-in aims at helping authors to easily create virtual interactive stories that explore the emotional dimension of characters and scenes in order to contribute to higher coherence of stories and simultaneously emphasize their communication purposes.

The focus discussed here is on the cognitive architecture for autonomous agents that play the characters. This architecture uses two main drives to decision making: (1) it makes use of emotions, based in Frijda's "emotion theory" (1986); (2) as well as a model of characters' roles proposed by Propp (1968). Characters' behaviour is, therefore, induced simultaneously by the intentions of the author, that specifies characters' roles and the emotions each scene should convey, and by the characters' own emotional experience while interacting with other characters in the story. The integration of both types of influence on characters' behaviour is crucial in systems, such as Teatrix, where users may play characters. The goal is to keep the author with some control over the story but at the same time not limit the user participation, since this would damage her/his interaction experience. This direct influence on the behaviour of the characters, and indirectly on the story, features the concept of

[1] Inscape is an authoring platform being developed in an EC-FP6 project.
[2] Teatrix is a tool that for helping children in the creation of stories.

agency defined by Murray (1997). This approach was already applied in Teatrix, since it merged the actor, author and spectator roles (Machado, 2004). Users were invited *to act* in an interactive story along with the other characters (autonomous characters controlled by the architecture or by other users), to create/author such a story by acting in it and to understand the others characters' actions – being a spectator – in order to respond to their behaviours. This new concept aims at overcoming one of the typical problems of interactive narratives/stories – *the higher degree of freedom that is given to the user to intervene in the narrative flow, the weaker is the power given to the author to decide on the progress of the story* (Clarke & Mitchell, 2001) – since the users and authors of the story are the same.

2. Authoring mode

We developed a plug-in to work with INSCAPE authoring platform and have been working on adapting it for the Teatrix platform, enhancing the characters affective autonomy. The plug-in is an authoring module that can orchestrate the main audiovisual aspects and then improve emotionality in virtual world scenes, characters and interactivity (Zagalo, 2007).
The communication model (see Fig. 1) behind the plug-in is defined as a group of templates that can be used to quickly generate atmospheres in story representations. The author is the person that starts the process and that uses the plug-in to build a more affective artefact and so reach more easily the *experiencer*. The author always has the final word in the entire process; deciding to use nothing, partially or fully what is proposed by the plug-in. On the other side, the *experiencer* approaches the final artefact in two different ways in affective terms, perceptually and emotionally. In the former, the *experiencer* can recognize the sequences as attached to specific affective states but not feel them. In the latter, the *experiencer* feels the emotions expressed by these affective states represented (consciously or unconsciously).

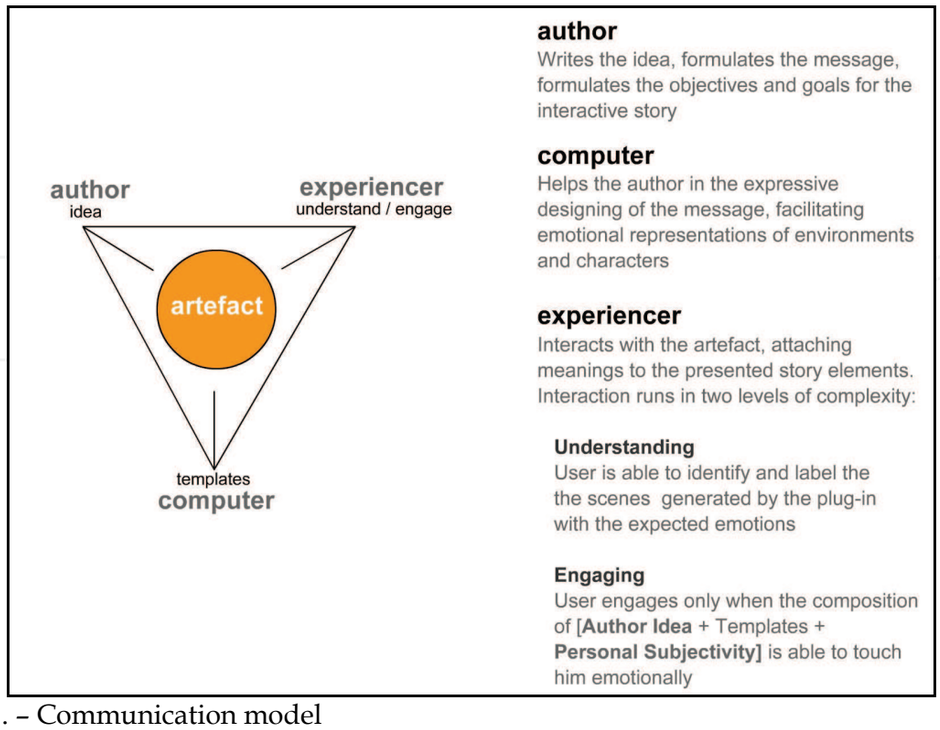

Figure 1. – Communication model

The plug-in is then targeted at producing a semantic intervention in the story that doesn't intend to transcend the storyteller work. The aim is to help authors to easily create interactive scenes that are identified by the authors and *experiencers* as attached to a specific type of atmosphere label and simultaneously to emphasize the communication process. The authoring intervention develops a pedagogical facet permitting the learning by the story authors about potential emotional uses of specific parameters.

The templates used by the plugin were made of audiovisual storytelling classes researched accordingly to their emotional impact in viewer. For the environment classes (see Table 1) they were firstly derived from Smith (2003) and were then verified through one or more authors (Block, 2001; Douglass & Harnden, 1996; Eisenstein, 1957; Mamet, 1992; Sonnenschein, 2001; Van Sijll, 2005). For the character's classes (see Table 1) we began within a theoretical approach from film studies (Smith, 1996) and videogames (Sheldon, 2004), then we have filtered this knowledge through communication theory (Knapp & Hall, 1997) and psychology (Argyle, 1975).

ENVIRONMENTS
Camera
Lenses, Motion, Position
Editing
Cuts and Pace
Time
Continuity and Variation
Frame
Composition and Shape
Screen Direction
3 axes (Up-Down; Left-Right; Back-
Music/Sound Qualities
Intensity, Pitch, Rhythm, Speed, Shape
Lighting
Motivation, Contrast, Tone
Color
Hue, Brightness, Saturation
Design Effects
Visual and Aural

CHARACTERS
Character's Space
Intimate, Personal, Social, Public
Physical Features
Clothes, Skin, Hair, Weight, Height
Body Movement
Posture, Gestures
Facial Expression
Face and Eyes
Touch
Types
Vocal Aspects
Tone, Types
Apparent Personality
Extraversion, Agreeableness, Consciousness, Neuroticism, Openness

Table 1. Environment and character's classes

All these classes were made part of a film content analysis study (Zagalo, 2007) performed with filmmakers and scriptwriters. The research conducted us to the creation of a storytelling affective parameters database. The plug-in then uses this database to act upon the environments and characters mixing different levels of expressivity. In terms of authoring the author can control an array of parameters through a simple set of sliders.

Thus, using a direct interface, the user is completely free to change the world and characters as he likes and in a much more straightforward way. Using one slider to add the percentage

he wants, seeing 100% effect and deciding in real time to reduce it to only 25% of the effect if required. In addition, the user can consider mixing various emotional categories to attain the expressivity s/he prefers for the ideal scene s/he is building.

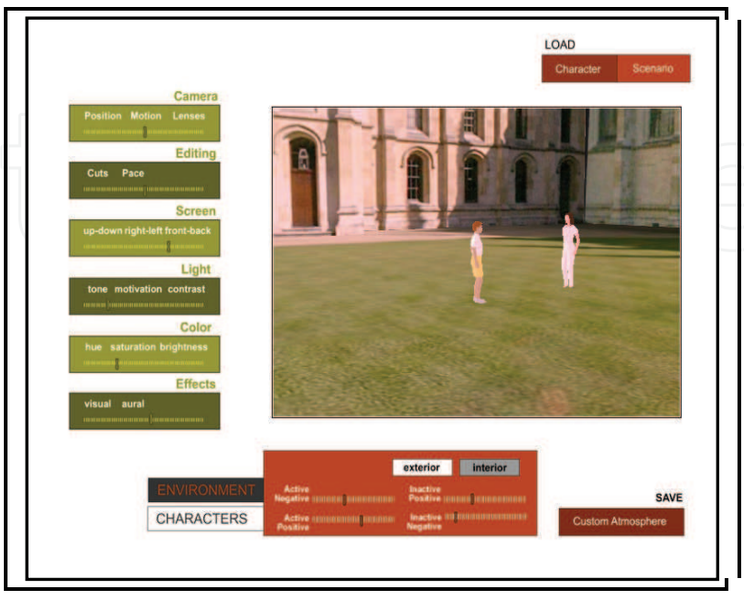

Figure 2. – The authoring plug-in interface

In terms of storytelling we can see in the fig. 3, this is a software module designed to act on form, and most specifically on story stylistics. This is a conscious choice in order to avoid the problem of entering the context and thematic domains, and also to avoid interfering too much with the Author core information message. With this storytelling approach, the author continues to be responsible for producing the idea, developing it and then, choosing the elements and interactions accordingly to needs.

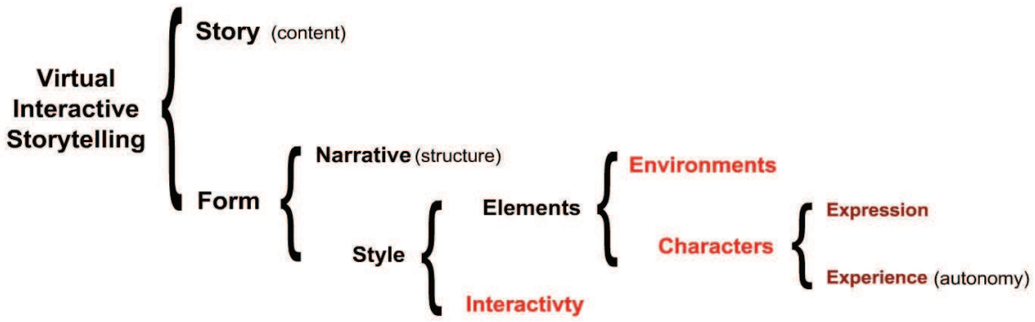

Figure 3 – The implementation process in the storytelling

Thus this leaves us with three variables to be effected by the authoring module – Environments, Characters and Interactivity – without causing direct interference in the author's work. For the authoring of characters, the author can start by assigning a predefined role accordingly to Propp (1968). This choice takes effect on the personality and so on cognitive model adopted by the agent, but then we have two emotion variables –

Expression and Experience. The Characters' expression refers to the visual expressions and movements performed by the characters in response to the emotional experience of the world. The experience encompasses the interpretation of the character/agent upon the stimulus received through own sensors of the world.
Next we'll explain the agent's architecture responsible for the character's interpretation and expression within the virtual world.

3. Agents' architecture

The architecture that drives characters' (*dramatis personae)* behaviour follows the approach of an agent being divided into well-defined parts: *mind* and *body* (see Fig. 4).
The *mind* component is responsible for cognitive activities of the agent, while the *body* component has as major function to receive and send directives to and from the story creation application. Usually, this component is also responsible for managing the physical appearance of the agent, but that representation is dependent on the specificity and requirements of story creation application, i.e., it is implemented within the application context. Nevertheless, within our architecture the bodies of the *dramatis personae* have a different interpretation and a different functioning because as *dramatis personae* they sense their world, process such information according to their reasoning processes and act in accordance with it. The body defines a set of sensors and actuators that are connected to the story world in order to enable the agent to receive the perceptions of what happened in the story and to send the action directives regarding the changes they want to produce in the story.

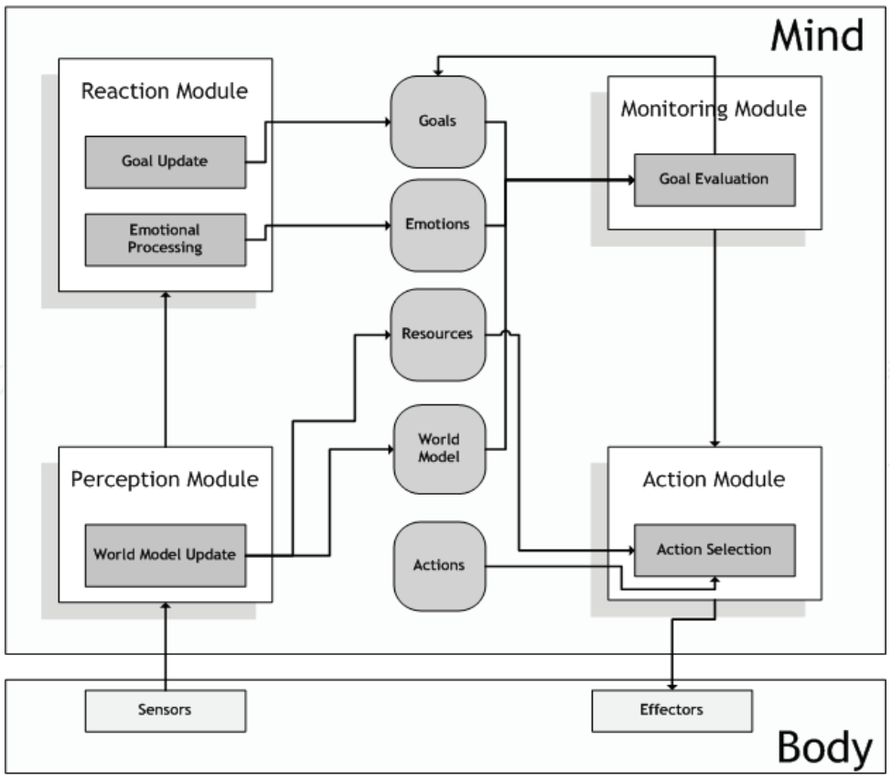

Figure 4. – Dramatis personae Architecture

This architecture is an extension of SAGA (Support And Guidance Architecture) and follows the work of C. Martinho (Martinho & Paiva, 1999), which had as its main goal the development of believable emotional agents – *pathematic* agents, and more specifically in Teatrix's story characters' architecture (Prada *et al.*, 2000). It is centred on the development of believable role-based characters, which play their specific roles in a particular story, adding an emotional perspective of their self experience in the story world.
The development of the *dramatis personae*'s behaviour is carried out according to a continuous cycle that goes from receiving a perception to the directive of performing an action by the agent's effectors. In the next sections, the different phases of the cycle are presented.

4. Perception phase (perception module)

In the Perception Phase, the dramatis personae's mind receives a perception from the story world. The perceptions received can contain several kinds of information: (1) an action performed in the story world by a particular dramatis personae; (2) an event describing the state of the story world, or an alteration of such state, e.g. a dramatis personae that entered a different scenario; (3) the introduction of a new prop in the story world.
By taking into account this perception, the dramatis personae decides if some change should be made to its internal world model. The world model contains the dramatis personae's point of view of the story world, i.e., the data contained in the world model corresponds to the perceptions received by the dramatis personae during the story evolution. Therefore, the dramatis personae constructs its world model from the events and actions already perceived.

5. Reaction phase (reaction module)

During the Reaction Phase, the character updates its internal structures, namely: the set of *goals*, the *physiological state*, and its *emotional state*.

- **Physiological state:** the physiological model comes from the need to incorporate internal states such as energy or "magical power" if , for example, the story allows characters to cast spells. These states can be used to control the level of activity of characters in the story, for example: (1) a character can be turned into *invisible*, it stays in the story but can only start to act if some magical prop is used and reverses this state; (2) it can be *immobilised*, being visible in the story world but without the possibility to perform any action, but could be saved by others; (3) or *neutralized*, being killed in the story, staying forever *immobilised*.
- **Goals:** in the reaction phase the character deliberates if it must alter its internal goals in accordance with the data received from its perception of the situation. Since this perception has been filtered in the previous phase, it is almost certain to have an effect on the character's active goals. Depending on the information contained in the perception, the character may have to deal with three different situations:
  1. *the information validates its current goal, and it continues to seek its attainment.* This validation only permits that the agent can proceed with the achievement of the current goal, i.e., meaning that the actions being performed are being successful and that the conditions for the further execution of the actions associated with such goal still verify;

2. *the information confirms the successful achievement of the current goal,* meaning that the current plot point was achieved by the character;
3. *the information confirms the failure of achievement of the current goal*, meaning that the story character may have to inspect its set of generic goals and choose another goal to be its current goal. This decision process is based on the assumption that its internal world model supports the necessary conditions for the goal activation.

- **Emotional state:** It is determined by the "emotion process" claimed by the cognitive appraisal theory of Frijda (Frijda, 1986). Frijda's emotion process consists into a decision system for action readiness and action determination. The core system is regulated by seven phases. Four of them are incorporated in the agent's Reaction Phase and three in the Action Phase:
  1. The first phase is an analyser that codifies events. This interpretation is based on the events acquired by the Perception Phase.
  2. In the second phase the event is evaluated according to its relevancy / irrelevancy to elicit pleasure, pain, surprise or desire. Emotions are held to arise when events are appraised as relevant to concerns[3].
  3. The third phase is a diagnostician that evaluates what can be made to cope with the event.
  4. The fourth is an evaluation system of the event strength, difficulty and seriousness. This phase is responsible to emit control sign of the results.

Frijda also argues that there are other factors responsible for the emotional responses determination (the humour, the activation state, the precedent experiences and the other people). It is also important to note that this model has a continuing feedback. Each emotion response is influenced by the precedent ones.

6. Monitoring phase (monitoring module)

All changes to the character's internal structures (e.g. goals, emotions, internal world model, physiological state) are evaluated to determine the most suitable behaviour to be carried out by the character. This behaviour may determine the need: (1) to activate a new goal, because the previous one failed to succeed or , on the contrary because it was successfully achieved; (2) to carry on with its completion of the current goal, or; (3) to trigger a reactive behaviour;
Reactive behaviours are needed to prevent the characters of performing their roles in an autistic way. The reason behind is the fact that in each story there can be autonomous and user-controlled characters. So, imagine that a user decides to direct her character in such a way that it would continuously use an attack/defence prop to harm an autonomous character. If that character did not have any particular interest in a direct interaction with the user-controlled character it would ignore the interaction and carry on with its actions. Thus, these reactive behaviours came from the need to accommodate user's needs and opinions during the story creation process. Furthermore, the introduction of reactive behaviours meets the requirements defined by Dautenhahn (1999) for a story-telling agent:

1. ability to recognise individuals;

[3] Concerns are defined "a disposition to desire occurrence or non-occurrence of a given kind of situation" (Frijda, 1986:335). It includes motives, major goals, personal sensitivities, attachments, and personal supra values.

2. ability to understand others;
3. ability to predict the behaviour of others and outcomes of interaction, and;
4. ability to remember and learn interactions with others and to build direct relationships.

The reactive behaviours are divided in two different categories:

1. **Friendly behaviours** – this apply to the behaviours taken by characters playing a compatible role to the one being played by the user-controlled character. Compatible roles are the ones shared by the characters playing roles that complement each other, in the sense that what a character contributes for the completion of another character's goals. The compatible roles are hero, donor, helper and others. This type of behaviour encompasses the friendly actions that are taken in response to a user-controlled character's interactions, such as: (1) respond in a friendly way to the questions posed by the user-controlled character; (2) share her/his goals with the user-controlled character; (3) give props that may be useful in the future actions.
2. **Unfriendly behaviours** – this category contains the behaviours taken in response of interactions elicited by incompatible roles. Incompatible roles are the ones played by the characters that have contradictory goals in the story. In saga, the incompatible roles refer to the opposition maintained by the villain character towards all the other roles. The unfriendly behaviour can be exemplified by the following actions: (1) respond in an aggressive way to the questions posed; (2) try to immobilise or neutralize the user-controlled character (e.g. by casting a spell); (3) never reveal their intentions and goals.

Additionally, there is also the need to include reactive behaviours in response to some of the plans elicited by some generic goals. For example, it is possible to detect some of these situations where the actions taken by the villain character directly affect the hero character or the beloved character, which presuppose that such characters must respond to them in some meaningful way. For example, if the villain character kidnaps the beloved character, she/he should respond in some way to this action – e.g. crying for help. To accommodate such direct interactions, it is decided that the set of active goals of such a character is added a new goal that is composed of a new plan to answer adequately to such direct interaction. It is important to say that the reactive behaviours can be primitive or non-primitive actions (see section Plans, Actions and Goals).

7. Action phase (action module)

In the Action Phase, the character has to decide which action should perform next. To support this decision the character considers the evaluation performed in the previous steps and chooses an action to execute. Before starting to execute a particular action the character must make sure that the pre-conditions for such particular action hold and that the necessary resources are available.

The choice of the action is performed in the following way. If there is not a reactive behaviour to be performed the character performs the action determined by the planning mechanism, otherwise the reactive behaviour always precede the execution of the other primitive actions. This process incorporates the last three phases of Frijda's emotion process (Frijda, 1986) already mentioned in the precedent Reaction Phase. The 3 phases corresponds to the following processes:

- The determination of the action plan, more precisely of the behaviours' sequences intended to put into action.
- The generation of the physiological change correspondent both to the emotional state originated and to the behaviours intended.
- The determination of the character action readiness to perform the action plan.

8. Roles

Each character has a role to play in the story, which was derived from the work of Propp which identified a set of functions that can be understood as both the actions of the characters and the consequences of these actions for the story. These functions are distributed among seven types of characters, such as villain, donor, helper, princess and father, dispatcher, hero and, false hero (see Table 2).

Character Type	Functions
Villain	villainy, struggle, pursuit, chase
Donor	1st donor function, receipt of agent
Helper	spatial change, liquidation, rescue, solution, transfiguration
Princess (and father)	difficult task, branding, exposure, punishment, wedding
Dispatcher	Absentation
Hero	counteraction, hero's reaction, wedding
False hero[4]	counteraction, hero's reaction, unfounded claims

Table 2 - Mapping of Propp's Character types into functions

Although, Propp's narrative morphology has been adopted as a starting point, it is clear that some of the functions must be adapted to today's reality and the context of usage. To accomplish this, the concept of function was extended to the concept of plot point - an important moment in the story (Mateas, 1999). At this stage, we go a step further in the specification of plot points and we establish that associated with each plot point is a set of generic goals. A generic goal is nothing more than a deeper elaboration of what the plot point stands for. For example, the plot point villainy has five associated different generic goals: theft, kidnapping someone, casting of a spell, imprisonment, and an order to kill/murder someone. Within each set, each generic goal is equally valid for reaching a particular plot point.

9. Plans, goals and actions

The goal structure is determined by the character's role in the story. The set of *goals* is determined by the set of *generic goals* associated with a specific *plot point*. Each of the generic goals is translated into a plan that guarantees the achievement of the correspondent plot point. At each moment, a *dramatis personae* has one active goal to pursuit. The methodology

[4] A false hero represents a character that pretends to be the hero and take his credits.

chosen for the definition of the plans associated with the generic goals was the Hierarchical Task Network (HTN) planning that creates plans by task decomposition.

Within our approach, the development of the story model was based on a hierarchical strategy - we started to define the major components of the model (the *functions* that were then *promoted* into *plot points*) and then to divide these *plot points* into smaller pieces that allowed their successful achievement.

Following the research of Kambhampati and his colleagues (Mali & Kambhampati, 1998), we assumed that there is no need to start from scratch to define a formalisation for HTN. The research followed by Kambhampati is based on the principle that most real-world domains tend to be *partially hierarchical*, which implies that a planner should apply an hybrid approach of using the reduction knowledge where possible and defaulting to primitive actions for other situations. The HTN approach here presented and applied is an extension of the action-based planning developed by (Kambhampati & Srivastava, 1995) to cover HTN planning (Kambhampati *et al.*, 1998). To these authors, HTN planning can be seen as a generalization of the classical planning problem where in addition to the primitive actions in the domain, the domain writer also specifies a set of non-primitive actions, and provides schemas for reducing the non-primitive actions into other primitive or non-primitive actions (Kambhampati *et al.*, 1998). It is a process where the tasks (non-primitive actions) are decomposed into smaller subtasks until primitive actions are found that can be performed directly (Tsuneto *et al.*, 1998; Kambhampati *et al.*, 1998).

To present this approach we start by introducing the notions of planning problem and partial plan. A planning problem is a 3-tuple $<I, \mathcal{G}, \mathcal{A}>$ where:

- I is the complete description of an initial state;
- $\mathcal{G}$ is the partial description of the goal state, and;
- $\mathcal{A}$ is a set of actions (also called operators). An action sequence $\mathcal{S}$ is said to be a solution for the planning problem, if $\mathcal{S}$ can be executed from I and the resulting state of the world implies $\mathcal{G}$.

A partial plan $\boldsymbol{p}$ can be described in the form of a 5-tuple $<\mathcal{T}, O, \mathcal{B}, \mathcal{ST}, \mathcal{L}>$ where:

- $\mathcal{T}$ represents a set of steps in the plan;
- O represents a set of ordering constraints;
- $\mathcal{B}$ represents a set of binding constraints on variables appearing in the pre and post conditions;
- $\mathcal{ST}$ maps a set of names to actions, and;
- $\mathcal{L}$ represents a set of auxiliary constraints that involve statements about truth of the specific conditions over particular time intervals.

The only extension required to the above definition of a partial plan representation to allow HTN planning is to include non-primitive actions into the plan. In particular, the steps $\mathcal{T}$ in the partial plan $<\mathcal{T}, O, \mathcal{B}, \mathcal{ST}, \mathcal{L}>$ can map two types of actions: *primitive actions*, which correspond to the usual executable actions and *non-primitive actions*. These non-primitive actions have similar preconditions/effects structure as the primitive actions. The domain specification links each non-primitive action o to a set of reduction schemas. Each reduction schema S_i can be seen as a 2-tuple: $<\mathcal{P}_i, \mathcal{M}_i^{\mathcal{L}}>$ where $\mathcal{P}_i$ is the partial plan fragment which can replace o, and $\mathcal{M}_i^{\mathcal{L}}$ redirects the auxiliary constraints involving steps of $\mathcal{P}_i$.

Therefore, given a non-primitive action (also denoted as task) to accomplish, the planner chooses an applicable schema, instantiates it to decompose the non-primitive action into other non-primitive actions (also called as subtasks), and then chooses and instantiates other schemas to decompose the subtasks even further. If the constraints on the subtasks or the

interactions among them prevent the plan from being feasible, the planner will backtrack and try other schemas.

The first step of the application of HTN Planning in our architecture is the definition of the ***HTN domain description***. This definition aims at defining which are the primitive and non-primitive actions of the domain. The set of primitive actions considered are:

- ***Walk to*** *entity*, specifies that a character performs the action *walk* towards the *entity* (e.g. character **A walks to** character **B**);
- ***Talk with*** *character*, specifies that a character performs the action *talk* with the character (e.g. character **A talks with** character **B**);
- ***Give*** *prop* [***to*** *character*], specifies that a character performs the action *give* with the object being *prop* and the target of such action the *entity* (e.g. character **A gives** prop **x to** character **B**). If this action is performed without a target *character,* it means that the character drops *prop* and it is available in the story world – more specifically in a particular scene.
- ***Get*** *prop,* specifies that a character performs the action *get* with the target being *entity* (e.g. character **A gets** entity **x**). The props must have the property of being portable. When a character *gets* a particular *prop* it is assumed that it keeps it in its possession for later use.
- ***Use*** *prop* ***on*** *entity*, specifies that a character performs the action *use* of *prop* on *entity* (e.g. character **A uses** prop **x on** character **B**), and;
- ***Activate*** *prop*, specifies that a character performs the action *activate* of a specific *prop* (e.g. character **A activates** prop **x**). The props must have the property of being activated, for example: activate a door would mean to open if it is closed and to close if it is opened.

Table 3 presents the complete set of the primitive actions and their pre-conditions and effects.

PRIMITIVE ACTION	PRE-CONDITION	EFFECT
WALK_TO(X,Y)[5]		NEAR(X,Y)
TALK_WITH(X, TXT)[6]		
TALK_WITH(X, TXT, Y)	NEAR(X,Y)	
GIVE(X, A, Y)	HAS(X,A) AND NEAR(X, Y)	HAS(Y, A) AND NOT(HAS(X,A))
GIVE(X,A)	HAS(X,A)	NOT(HAS(X,A))[7]
GET(X,A)	IS_PORTABLE(A)	HAS(X,A)
USE(X,A, Y)	HAS(X,A) AND NEAR(X, Y)	DEPENDS ON THE TYPE OF PROP A
ACTIVATE(X,A)	NOT(ACTIVE (A)) AND NEAR(X,Y)	ACTIVE(A)

Table 3. – Primitive Actions

[5] Consider that X, Y denote a character and A a prop.
[6] Consider that TXT denotes the text being spoken.
[7] The object A is now available in the story world.

As one can realise from this set of primitive actions, the effect of some of the actions depend on the props used, mainly in actions *use* and *activate*. The specification of such details is performed by the *client* application when it defined the elements of its story world.
The set of primitive actions is very limited, but has the property of being easily extended because the majority of the actions depend on the props being used in such actions. In addition, the action ***talk*** can also be extended to something more complex like speech acts, and express things like *threathen*, *inform*, etc.
The set of non-primitive tasks is lengthy since it represents not only the whole set of generic goals associated with each plot point, but also the non-primitive actions that compose such generic goals. Table 4 presents a sample of the set of generic goals regarding the ***villain*** role. Note that, since the character performing each of the actions (primitive or non-primitive) in the reduction schemas is the character performing the ***villain*** role we decided to omit its explicit reference in the schemas.
Each reduction schema is a an expression of the form *Decompose*(***o***, ***p***), which means that a non-primitive action ***o*** can be decomposed into a partial plan ***p*** (Russel & Norvig, 1995). The representation of a partial plan ***p*** is represented as a 4-tuple $<\mathcal{T}, O, \mathcal{B}, \mathcal{L}>$, which is a simplification of the 5-tuple $<\mathcal{T}, O, \mathcal{B}, \mathcal{ST}, \mathcal{L}>$ presented above. We considered that each generic goal would only have one reduction schema for its achievement.

Generic Goal	Schema
Theft: It is considered that the object of theft is the desired entity established within the story goal.	Decompose(Theft(), Plan (Steps: {s_1: LookFor(desired prop[8]); s_2: Get(desired prop)}, Orderings: {$s_1 \rightarrow s_2$}[9], Bindings: { s_2: has(villain, desired prop)}, Links: {}))
Struggle with the hero: In this case, it is assumed that the villain wants to defeat the hero character by the use of a magical entity that would prevent her/him to go further in the story. This is performed by using a magical entity that turns the hero's energy level to immobilised. This energy state is different from neutralised one, since in this state it is still possible to use another magical prop that reverses it.	Decompose(Struggle(), Plan(Steps: {s_1: LookFor(magical prop); s_2: Get(magical prop); s_3: LookFor(hero); s_4: WalkTo(hero); s_5: Use(magical prop, hero)}, Orderings: {$s_1 \rightarrow s_2$, $s_2 \rightarrow s_3$, $s_3 \rightarrow s_4$, $s_4 \rightarrow s_5$}, Bindings: { s_2: has(villain, magical prop); s_5: $(hero)_{ENERGY}$ = immobilised}, Links: {$s_2 \rightarrow^{MAGICAL\ PROP} s_5$}))

Table 4. - Some generic goals for the **villain** role.

[8] DESIRED PROP denotes a prop with no specification of type.
[9] $s_i \rightarrow s_j$, which is read as s_i must occur sometime before s_j (but not necessarily immediately before).

10. Conclusion and perspectives

In this paper we've presented the architecture developed to sustain a storytelling authoring plug-in module based on Propp's functions and roles with support for emotional responses. Developed for the specificities of INSCAPE and Teatrix but having in mind adaptation to work within other virtual environments authoring tools.

The integration of Propp's guidelines to drive characters' behaviour gives some control of the story to the author, but adding an emotional dimension to the same characters withdraws part of this control from the author by allowing characters to have some personal experience in the story that affects their actions. This duality is essential in systems that promote user interaction (for example, where a user can play a character), since it brings some uncertainty and flexibility to the plot defined beforehand by the author. Thus, opens the opportunity for the user to play the role of author and have a feeling of ownership of the story.

Furthermore, apart the usability tests performed with the authoring module we intend to continue the testing making use of the integrated tests. These tests will put the user within an entire mode of story development and then give the opportunity to the author to use the authoring module during the story design. The main reason for this is to test the real value of having one module that works as an intermediary of the authoring process.

Also we intend to continue working and perfecting the character models and adapt the agent behaviours to the environments. Use the environment as a general entity controlled through an agent architecture in terms of emotional actions upon the characters.

On the other side we would like to expand the authoring module with another layer related with the control of events/information in the storytelling, making use of management models (Mateas and Stern, 2005) to control the flow of events presented to the agents and players.

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Affective Computing

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This book provides an overview of state of the art research in Affective Computing. It presents new ideas, original results and practical experiences in this increasingly important research field. The book consists of 23 chapters categorized into four sections. Since one of the most important means of human communication is facial expression, the first section of this book (Chapters 1 to 7) presents a research on synthesis and recognition of facial expressions. Given that we not only use the face but also body movements to express ourselves, in the second section (Chapters 8 to 11) we present a research on perception and generation of emotional expressions by using full-body motions. The third section of the book (Chapters 12 to 16) presents computational models on emotion, as well as findings from neuroscience research. In the last section of the book (Chapters 17 to 22) we present applications related to affective computing.

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