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First set of case studies in Narrative Learning Environments

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Summary

This deliverable describes and analyses a set of case studies of narrative learning environments. It also provides a summary with the classification of each application according to four dimensions (knowledge domain, role of the user towards the story, learning approach and technological means).

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1 Introduction

In this document we describe and analyse a first set of applications of Narrative Learning Environments (NLEs). In particular, we provide an extended overview of those included in (Vaz et al, 2005) and in (Giannetti and Earp, 2005).

One of the discussion groups created during the first Kaleidoscope Workshop on Narrative Learning Environments¹ pointed out the need to highlight the main features of narrative learning environments. As a result, this discussion group (Aylett et al, 2005) proposed a classification of NLEs based on four dimensions:

1. **knowledge domain**, which includes language learning, learning to construct a story, social learning and coping strategies, sciences and decision making;
2. **role of the user towards the story**, namely story authoring (inventing a story), story telling (narrating a story previously created, by the same user or by someone else), story audiencing (the learner/user acting as an observer) and story experiencing / participating (taking part in story creation or telling);
3. **learning approach**, which includes challenge-based/game-based, collaborative/cooperative, situated/case-based, empathy-driven and role play learning;
4. **technological means**, such as 2D graphics / animations, 3D virtual environments, ubiquitous computing, mobile technology, augmented reality, tangible interfaces, intelligent agents, natural language processing or speech recognition and generation.

By observing these four dimensions we find that the considered NLEs are very rich and diverse in terms of their goals and functionalities.

Since the considered environments would be grouped differently according to each of the above dimensions, we decided to present them in alphabetic order. However, a classification of the applications analysed, based on possible instantiations of the four dimensions, is presented in the appendix, at the end of this report. In this way, we hope to help the reader to easily search for NLEs that are built with specific characteristics, or even to inspire the creation of other NLEs.

2 Carmen's Bright Ideas (CBI)

2.1 Overview

Carmen's Bright IDEAS (see Fig. 1) is an interactive health intervention program designed to help mothers of paediatric cancer patients deal with their problems. The main characters in the story are Carmen and Gina, her counsellor. Carmen has two children and because one of them suffers from leukaemia she is facing several problems and is living a stressful situation.

¹ For more information on this workshop visit <http://gaips.inesc-id.pt/kw-nle/>.

Stacy Marsella (Marsella et al., 2000) applies the term *interactive pedagogical drama* to such style of instruction that teaches the skills necessary to cope with complex social situations. The aim of this kind of application is to present believable characters that face and intend to solve some difficulties similar to those of the user, who is thus led to learn skills that can be applied to his/her own problems.

As concerns interactive narrative applications, the authors of CBI distinguish *immersive* and *presentational* systems. In the former, users participate directly in the story, in a first-person perspective, while in the latter the user can influence the course of action, although s/he is not explicitly present as a character within the story. The presentational strategy was adopted in CBI for technical and clinical reasons, in that it allows a separation between the problems of the character and the user. It also enables greater flexibility in story direction and presentation, since flash-backs, close-up shots and cross cuts can be easily integrated. Furthermore, this facilitates the integration of the expertise of directors and scriptwriters, as they are more familiar with this type of systems.

The software application of CBI was developed using the so called Bright IDEAS method, where IDEAS stands for “*Identify* a solvable problem, *Develop* possible solutions, *Evaluate* your options, *Act* on your plan and *See* if it worked” (Marsella et al., 2000). This method of social decision-making and problem solving is applied in clinical settings.

The story is organised into three acts:

- in the first act, the learner (a mother) is presented with a sequence of situation vignettes, which show some back-story for the Carmen character. This sequence aims at helping the learner to identify and empathise with Carmen;
- the second act takes place in the counsellor’s office, where Carmen discusses her problems with Gina, the counsellor. This discussion is done by first selecting a problem to analyse, and develops through the evaluation of the possible solutions. During the analysis of the problem the action may flash back as Carmen recalls events that occurred in the past, or flash forward as she imagines possible outcomes of her actions;
- in the third act Carmen executes the actions that she agreed upon and observes the consequences of such actions.

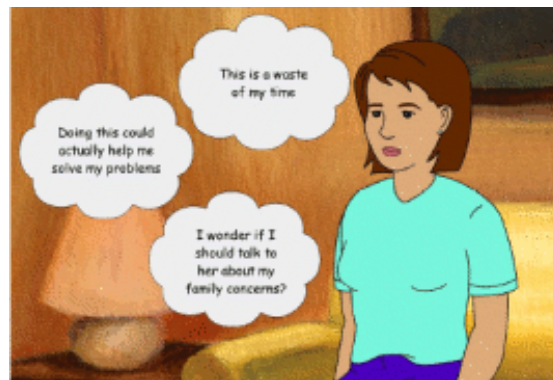


Figure 1 - The user is asked to select among Carmen's thoughts².

² From (Marsella et al., 2000).

The interactivity of this application varies from act to act, but even with the first act, which is fixed, the learner is presented with a set of balloons, containing thoughts and emotions, and is asked to choose what she believes Carmen's thoughts would be as a reactions to the actions on those scenes (see Figure).

In this way, the user is always able to influence the flow of action within the story and to develop a model of Carmen's emotional state that will guide the interactions during the story progression. The second act is the more interactive one, since the mother selects the thoughts for Carmen and the character acts immediately upon those thoughts. The story progression in this phase is highly dependent on Gina's judgment since she is the one that, based on the thoughts selected, decides if a further elaboration is required or if the current topic of the Bright IDEAS method is already sufficiently discussed.

Directorial responsibility in CBI is shared between user and an intelligent agent that acts as a director (Marsella et al., 2000):

“The learner directs the thoughts and emotions of the main character in the story, Carmen. Instead of manipulating Carmen as a puppet, the learner controls Carmen at the intentional level, choosing among possible thoughts and feelings that Carmen might have in the current situation. (...) The subtask of handling the cinematography is passed to an off-screen cinematography agent who handles the camera and revelation of story through flash backs and flash-forwards.”

The role of the director in CBI was explicitly given to one of the characters, Gina. The control Gina has over Carmen (and subsequently, over the learner) is achieved through the dialogue, which guides Carmen to follow the IDEAS methodology. In that sense, narrative management in CBI is mostly dialogue management applied to a particular domain.

The application was tested in a real setting and the results showed that the mothers identified themselves with Carmen and with Carmen's problems and found her solutions believable. Gina's presentation of the Bright IDEAS concepts was also seen as clear, and helpful in reinforcing their own knowledge about the method.

2.2 NLE specificities

Carmen's Bright IDEAS has the following specificities:

1. In terms of knowledge domain, this application is designed to develop **coping strategies** in the learner;
2. the learner plays just the role of an **observer** and not of an author because, even though she influences the course of the story, she doesn't have the power to create it;
3. the learning approach is **empathy-driven**;
4. this environment uses **2D graphics** and an **intelligent agent** with an **emotional model**.

3 D.Film Moviemaker

3.1 Overview

D.Film Moviemaker (see Figure 2) is an “open” narrative-based software that is available on the web. With this program students can create short comic-strip-type animated cartoons simply by selecting from the set range of backgrounds, characters, situations and music on offer, and then inputting their own dialogue text and titles. The result, which can be saved online, is a personalised comic strip with a very limited degree of animation: the characters simply move in and out of frame according to the type of situation selected (rendezvous, pick-up, chase, soliloquy).

The main attraction of this simple, easy-to-use program lies in its immediacy for creating dialogue-based narratives, though without voice recording. It does not provide the same flexibility for narrative development compared with the software examined above, nor does it feature specific language learning tools. Nevertheless, it remains a fun way of working with dialogues in the foreign language class, particularly at secondary school level.

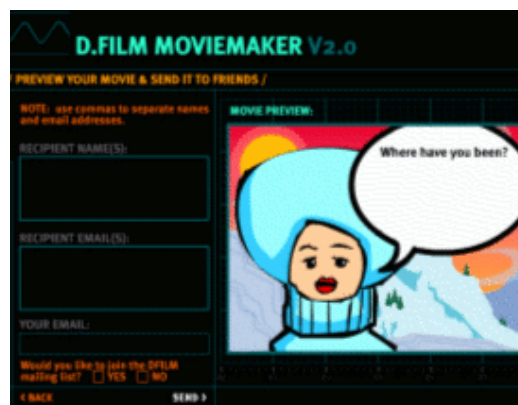


Figure 2 - Screenshot of D.Film Moviemaker.

3.2 NLE specificities

D.Film Moviemaker has the following specificities:

1. this application aims at promoting **story creation** and can be used for **language learning**;
2. the user acts as the **story author**;
3. the learning approach is **situated/case-based**;
4. D.Film Moviemaker uses **2D graphics**.

4 FearNot!

4.1 Overview

The Victec (Virtual Information and Communication Technology with Empathic Characters) project aims at the prevention of aggressive behaviour of school children by inducing empathy in children. The ideas of this project were embedded in a software application named *FearNot!* (Fun with Empathic Agents to Reach Novel Outcomes in Teaching).

This interactive application consists in a simple scripted scenario, depicting a scene to introduce the characters followed by a bullying scene (in this case physical bullying) and a final educational message. It was built as a 3D interactive graphical world, which uses cartoon-like images of the agents.

The aim of this application is to induce affective responses in children during bullying situations, and thus “change their behaviour and cognitions” (Schaub et al., 2003). In order to achieve that, the characters play a bullying situation, placing the child as an observer.

This demonstrator creates an episodic narrative of, direct or relational, bullying situations that can take place in a school. It generates a sequence of short episodes. At the end of each episode, children interact with the characters and give advice (see Figure 3). These pieces of advice influence the following episodes.

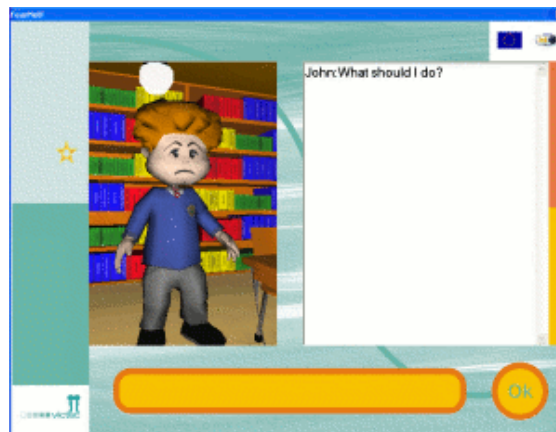


Figure 3 - The victim is asking the child for an advice.

FearNot! is based on the use of a virtual learning environment where self-animating empathic characters simulate bullying situations using emergent narrative, that is narrative that is produced through the use of intelligent synthetic characters implemented with an emotional model and a social memory. In other words, the behaviour of the autonomous agents produces the narrative. The characters’ goals and behaviour are a direct consequence of their emotional state. Their actions are a consequence of their perceptions of the world, which are a result of interacting with each other or with the child.

4.2 NLE specificities

FearNot! has the following specificities:

1. this program aims at developing **social competence**, by making the child understand other children and becoming able to solve conflicts;
2. while watching the bullying episodes the child is an **observer**, but during the interaction with the victim he is a **participant**;
3. the learning approach is **empathy-driven**;
4. the application uses a **3D environment** with **intelligent agents**, that are supported by an **emotional model**; **natural language processing** is used to a small extent.

5 Ghostwriter

5.1 Overview

Ghostwriter (see Fig. 4) is a virtual role-play environment developed with the aim of being used as preparation activity for writing stories (Robertson and Oberlander, 2002). The application takes the form of a game which is story-based, with the plot emerging from the role-playing activities and the story predefined components of characters, setting, and conflict between characters. The game tells the story of two children (the role-players) which were sent by their Granny to find Fred, an old friend who is kept prisoner in a castle. At each game interaction there are two players – performing the roles of Daniel and Jenny – and a role-play leader that interacts with the other players by using the characters Lady Searle and Fred. The role-play leader is responsible for assuring that the story evolves and eliciting emotional engagement with the characters and plot.



Figure 4 - Screenshot of Ghoswriter.

The results obtained from an evaluation of Ghostwriter showed that children who find difficult to write were very keen on interacting with the system and though they had problems with typing the messages, they kept trying. In addition, the influence on the written material produced after having interacted with the application was significant, in

the sense that there were more portrayals of relationships between story characters – implying that children understood that the story progressed mainly because they directly interacted with the story characters.

5.2 *NLE specificities*

Ghostwriter has the following specificities:

1. this program aims at promoting **story creation**;
2. the user is a **participant** in the story;
3. the learning approach is **collaborative** through **role playing**;
4. Ghowstwriter is embedded in a **3D virtual environment** with **intelligent agents**.

6 Kar2ouche Composer

6.1 *Overview*

Kar2ouche Composer (see Figure 5) makes it possible to create talking comic strip type stories or storyboards with three-dimensional images, speech/thought balloons and captions space. This application also features somewhat more sophisticated controls, such as sizing and rotation of characters and props. Students have up to four audio tracks available for the voice recordings, music and sound effects that are to accompany the frames: an editing control panel makes it possible to set the duration of each panel and the length of those recordings, so that the entire narrative can be orchestrated and saved for play back as a multimedia film, albeit as a sequence of still frames (if desired, a staccato-type animation effect can be achieved by rapidly "flicking" frames, though the program is clearly not designed with animation in mind).

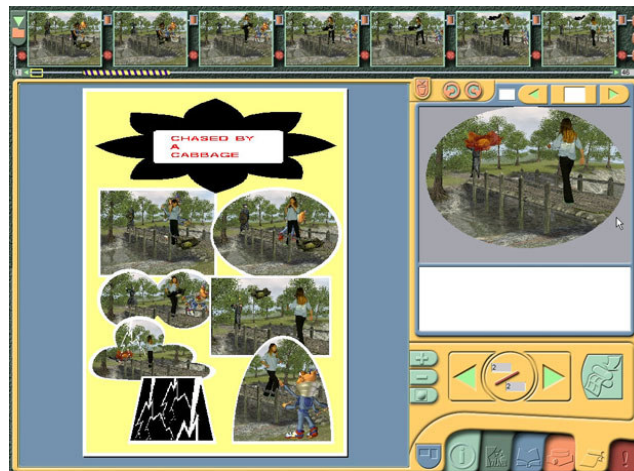


Figure 5 - Creating a storyboard with Kar2ouche³.

³ From http://www.immersiveeducation.com/uk/Kar2ouche_WhatIs.asp.

The absence of animation in Kar2ouche Composer's comic strip format means that the author needs to focus more closely on dialogue for developing narrative: in this way the actions and events unfold mainly through the verbal exchanges between the characters (this is supported by a rich repertoire of positions and gestures available for each character). So, while the program might be used at upper primary school level, it is more suited for foreign language learning at lower secondary school and above, where students' grasp of the target language (and of social interaction) is more developed. The program's characteristics make it extremely useful for creating role-plays, which might subsequently be performed by the students in class.

Kar2ouche Composer can also be used with any of the Kar2ouche Content Libraries, which include characters, backgrounds, props, text and audio files within specific themes. The available libraries cover a diversity of learning domains, such as history, languages and sciences.

6.2 NLE specificities

Kar2ouche Composer has the following specificities:

1. this application aims primarily at promoting **story creation** and **language learning**, but when used with the external libraries, it can also be used for learning **history** and **political sciences**;
2. the user acts as the **story author**;
3. the learning approach is **situated/case-based**;
4. Kar2ouche allows overlaying of **2D images** and **graphics**.

7 MediaStage

7.1 Overview

By the same publisher as Kar2ouche, MediaStage (see Fig. 6) allows students from secondary school upwards to create 3D animations that end users can move around in with a certain degree of freedom. Student authors can “direct” virtual characters by determining their movements and gestures, and also by getting them to “recite” the lines of dialogue attributed to them: these can be written by the students themselves or taken from the program's repertoire of English phrases and expressions. The dialogue can either be recorded by the students or reproduced by a text-to-speech engine: in the latter case the program generates automatic animated lip synchronisation to create a more realistic impression of speaking. Sophisticated controls are available for determining lighting effects, camera angles, etc.

MediaStage is designed chiefly for exploring the characteristics and dynamics of film and video making and could prove a bit complex for use in the foreign language classroom. That said, the possibility of producing an animated narrative in a virtual 3D environment makes this program particularly appealing to visually-oriented, computer-savvy students, especially those keen on films and computer gaming. The author can attribute certain behaviours and emotions to the characters, which the program

reproduces automatically in their movements and gestures, and this feature could prove an interesting area to focus on for language learning purposes.

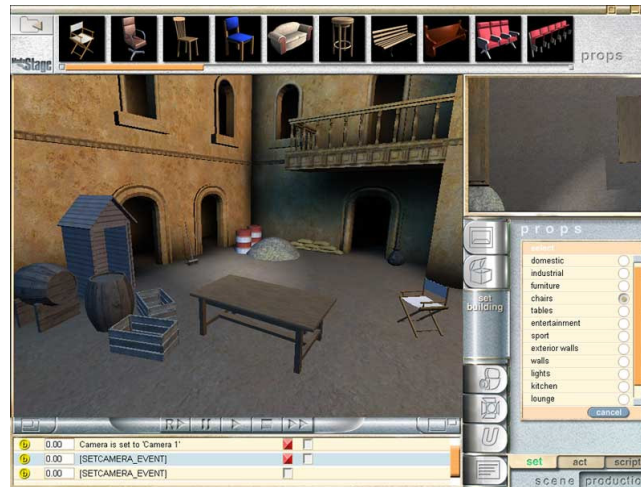


Figure 6 - Adding props to the scenery.⁴

7.2 NLE specificities

MediaStage has the following specificities:

1. this program aims at promoting **story creation** and **language learning**;
2. the user acts as the **story author**;
3. the learning approach is **situated/case-based**;
4. MediaStage is embedded in a **3D virtual environment**.

8 Mission Rehearsal Exercise

8.1 Overview

The Mission Rehearsal Exercise (MRE) system is a virtual training environment (Gratch and Marsella, 2001), whose purpose is to train army leaders facing socially delicate situations, in peacekeeping and disaster-relieving missions.

The goal of the MRE system is to provide an immersive and interactive learning environment, where the participants experience the same ambience they would encounter in real-world scenarios while performing mission-oriented training. In this case, the learners are asked not only to develop the competence in carrying out a particular task, but also to get familiar with the emotional and tense environment that they will be exposed to in a real-world scenario (and which can have a high influence in the way they perform such tasks).

For this purpose, the authors adopted a Hollywood-style hybrid approach to create this application. Using the Hollywood experience in delivering effective stories, they

⁴ From http://www.immersiveeducation.com/uk/MediaStage_Default.asp.

developed a story structure, the StoryNet. The story is structured into nodes, which are confined areas where the user can freely interact.

These nodes are connected (and contextualised) through *links* that are linear (scripted) sequences of events. Each node corresponds to a task or a decision.

The StoryNet corresponds to a plot-like representation of the consequences of user action. The plot models need not necessarily explicit, but rather derive from rules depending on user's decisions in specific key points.

This system integrates aspects of both plot-based and character-based systems. It is strongly centred on user behaviour and assumes constant user involvement. The StoryNet allows a mix of linear and non-linear story elements and provides control points for the Director Agent.

Intelligent agents control characters in the virtual environment, playing the roles of locals, friendly and hostile forces, and other mission team members. The initial prototype contains three interactive characters and about forty pre-scripted virtual ones that play the roles of various human beings in a military peacekeeping exercise.

In the prototype scenario, for instance, a human participant is in charge of a platoon of soldiers that have become involved in an automobile accident while driving to meet another platoon in need of reinforcement (see Figure 7). The learner must decide how best to allocate his/her forces between the conflicting goals of assisting an injured civilian and completing his/her mission.

MRE's training scenarios are based on the input of professional storywriters with the aim to engage the learners in an interactive experience as they are achieving the skills related to the mission. The training scenario is essentially an interactive story whose outcome depends on the decisions and actions that participants take during the simulation: the final goal is to prepare decision-makers that are able to take appropriate decision under stressful conditions.



Figure 7 - Prototype scenario of MRE⁵.

The prototype was demonstrated and the anecdotal feedback was very encouraging (for instance, a U.S. Army Colonel began narrating a related incident after seeing the demo, became quite emotional, and concluded by saying, “this system makes people feel, and we need that”). However, the authors already detected some faults:

⁵ From (Gratch and Marsella, 2001).

- the scarce interactivity of the prototype - as it is, although there is some variability in the order events can occur, the scenario is essentially a linear narrative with one branch point (based on how many squads the lieutenant sends to reinforce the other platoon);
 - the speech recognition engine, which covers a quite limited grammar;
 - the use of motion-capture data for the motions and gestures of the animated characters, which generates fluid and realistic motion but is not suited for real-time interactions.

8.2 *NLE specificities*

The Mission Rehearsal Exercise system has the following specificities:

1. this system aims at developing **decision making** competence;
2. the user acts as a **participant**;
3. the learning approach is **game-based**;
4. this application is also embedded in a **3D environment** with **intelligent agents**.

9 SAM - The shared reality

9.1 *Overview*

The act of telling stories is a natural activity among children, promoting cognitive development and refining the way children see and understand the world around them. At the same time, it enables the children to practise their language skills. Sam intends to stimulate this activity, acting like a virtual playmate, driving the child's active participation in the creation of stories.

Sam is a virtual peer designed to engage in specific kinds of storytelling with children. The system has two components: an embodied conversational agent - a life-size gender-non-specific child named Sam - and a toy castle with several plastic figurines. Sam can act as a peer playmate to children, telling stories by turn-taking with them and sharing physical objects across the real and virtual worlds (Cassell et al., 2000). The child and the character share the play space, which is thus partially real (the room where the child is playing) and partially virtual (the wall where Sam is projected) (see Figure 8). The connection between the real and the virtual worlds is accomplished through the use of a toy castle which has a physical half leaning against the projection wall and a virtual half that continues in the projected images, thus creating the illusion that the castle exists beyond the real world. There is also a set of story-evoking toys that the child can share with Sam by putting them in an *ad hoc* room of the castle; when a toy is put by the child in this room, it appears in the hands of Sam on the wall; hence, these toys exist both in the real world and in the virtual one. This technical solution is called augmented reality.

The stories, built with the help of Sam, are usually first-person stories, that is, where the child is also a character. They begin with the introduction of a scene and involve complicating actions (e.g. losing a horse) and a resolution (e.g. finding the horse).

This system allows the child to interact with the synthetic character and using the castle and the toys, imagining and narrating a story. Sam participates in the conception of

the story and continues the narration where the child leaves it off. The interaction goes on in the same way, sharing the toys between the virtual and the real world.



Figure 8 - A child interacting with Sam⁶.

The evaluations already performed by Cassell (2001) show that Sam:

- engages children's oral storytelling skills;
- promotes whole-body play with familiar toys;
- allows children to produce their own personally meaningful content.

This system, which includes work with several technological means (such as synthetic characters and tangible interfaces), has 3 key aspects that stand out:

1. The shared reality between the two worlds;
2. The synthetic character that acts as a virtual playmate;
3. The exploitation of the child's active participation.

Shared reality The apparent integration between the physical reality and the virtual world, allows the system to become believable and appealing to the child, by stimulating the willingness to cooperate with the synthetic character.

Note also that the simple way the real and the virtual world blend together is quite ingenious, as the sharing of the toy is used indirectly to solve the turn-taking problem.

The virtual playmate The success of the system depends greatly on the synthetic character itself and how well it can simulate to be a real child. Thus, Sam had to be modelled according to the social and cognitive skills of a normal child. The voice and the appearance of the character as well as its behaviour should make the child consider Sam as an equal, so s/he will not feel intimidated.

The active participation of the child Research shows that narratives created by children in groups are more complex and imaginative than those created by individual children. Thus, to make the experience richer, the presence of a companion that participates and helps the child is important.

9.2 NLE specificities

SAM has the following specificities:

⁶ From (Cassell et al., 2000).

1. it promotes **story creation**;
2. the user acts both as a **story observer** and a **story author**;
3. the learning approach is **cooperative**;
4. the technology used within SAM includes a **3D environment** with **tangible, interfaces, augmented reality** and an **embodied conversational agent**.

10 StoryMaker 2

10.1 Overview

Story Maker 2 (see Figure 9) is a software application designed to let primary school students create multimedia stories as part of their (foreign) language learning. It offers content (backdrops, characters, and props) that reflects both the English-speaking and French-speaking cultural contexts, and provides support for a number of other European languages in the form of text-to-speech voice synthesis and choice of interface language.

In their work, young authors can easily embed graphic elements and animations, as well as hypermedia links to be activated when the end users (the authors themselves, classmates, peers, parents, etc.) interact with the final narrative. Even young children can use this program to build a linear narrative, organised as a sequence of “pages” or scenes, or, alternatively, a hypermedia narrative with a branching structure that the end user is free to explore.

The basic components of each scene (backdrop, characters, props, details, sound effects, etc.) can be selected from the program’s repertoire of elements and inserted in simple drag-and-drop mode: authors can also insert their own images or sounds to personalise the production further. Figures and objects in the scene can be animated simply by dragging them in the desired fashion around the screen: a range of fine-tuning options is available. Spoken dialogue can be recorded, or written and reproduced automatically by the program’s customizable text-to-speech system, which “pronounces” written language via automatic voice synthesis: this feature is available in a number of different European languages, including a special version of English designed for foreign language learning. In either case, vocal tracks can be associated to cartoon-like speech/thought balloons encapsulating written text or images. The authors can embed hyperlinks so that animations, voices and sounds will be activated automatically in the program’s *Play* mode or are to be triggered by the end user when interacting with the narrative. These links can also be used as a bridge from one scene to another, permitting the authors to design interactive branching narratives. Both in the authoring and *Play* modes, the learner can choose to activate English-language text and sound tags identifying the various elements in the story (objects, animals, characters, etc.), a feature that is particularly appealing for developing and reinforcing children's grasp of English vocabulary.

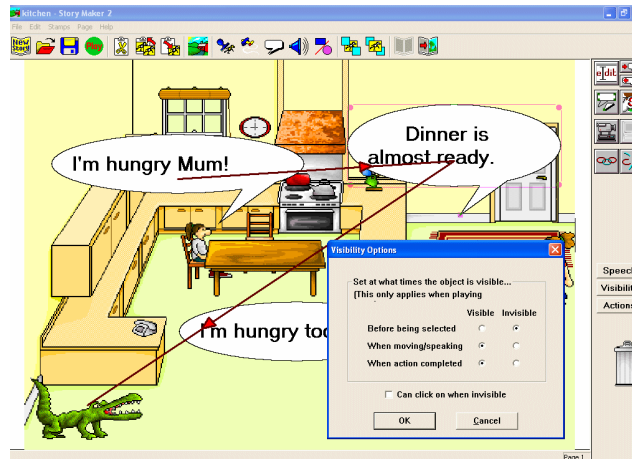


Figure 9 - Authoring Mode of StoryMaker 2.

10.2 NLE specificities

StoryMaker 2 has the following specificities:

1. it promotes **story creation** and **language learning**;
2. the user acts both as a **story observer** and a **story author**;
3. the learning approach is **situated/case-based**;
4. this application provides **2D graphics** and **animations**.

11 Tactical Language Training System (TLTS)

11.1 Overview

The Tactical Language Training System (TLTS) (see Figure 10) is designed to help people who wish to communicate properly in Arabic countries to acquire basic communicative skills by practising the language and learning culturally appropriate gestures.

The system provides short game-like episodes where the learner needs to communicate with native speakers and perform certain tasks. To this end, the user speaks in Arabic to a microphone, and chooses a gesture from a palette available to him. Afterwards, he receives the appropriate feedback from the system, if he makes any mistake. The detection of errors covers a wide range of linguistic aspects, including phonetics and vocabulary.

The system design includes three main components:

Mission Practice Environment (MPE) – this environment is responsible for the interface of the 3D simulations of social situations and for the agents which appear in them. These agents include social puppets, which can plan their appropriate verbal or non-verbal behaviour;

Mission Skill Builder (MSB) – this component consists of a tutoring environment, which decides the exercises and lessons to be performed. The MSB is responsible

for teaching the learner mission-oriented vocabulary, pronunciation and gesture recognition (Johnson et al., 2004);

Medina – this authoring tool, which is still under development, when integrated with the other components will be used to create the curriculum and game content.

These components interact with the curriculum database, the language model, the learner model and a pedagogical agent. The pedagogical agent was created to “determine how the virtual tutor in the MSB should respond to learner actions” (Johnson et al., 2004).

So far, and according to Johnson et al. (2004), the Tactical Language System “has already made rapid progress in combining pedagogical agent, pedagogical drama, speech recognition, and game technology in support of language learning”.

In the future, the system will include a director agent which will be able to influence the characters and the course of events by predicting the actions of the user. His aim will be to ensure the pedagogical and dramatic goals of the system (Johnson et al., 2004).



Figure 10 - The user is greeting a man in a cafe⁷.

11.2 NLE specificities

The Tactical Language Training System has the following specificities:

1. this application fosters the acquisition of **language knowledge** and **social skills** in a **foreign context** – Arabic countries;
2. the user acts as a **participant**;
3. the learning approach is **game-based**;
4. this program is also embedded in a **3D environment** with **intelligent agents** and allows **speech recognition and generation**.

⁷ From (Johnson et al., 2004).

12 Teatrix

12.1 Overview

Teatrix (see Fig. 11) is a 3D virtual learning environment, which allows children not only to participate in the creation of stories but also to take the role of a character.

Its purpose is to “help children, and their teachers, in the whole process of collaborative story creation” (Prada et al., 2000).

This collaborative virtual environment for story creation aims to provide effective support for young children by developing:

- their notions of narrative, through the dramatization of several situations;
- their ability to take a 2nd and 3rd person perspective across the experience of a wide range of situations.

The aim of Teatrix was not to develop a research system detached from the educational reality and from the children’s needs and requirements, but rather a computational environment that would be seen by children and educators as something which is an extension of their daily pedagogical and curricular activities.



Figure 11 - The Backstage Phase of Teatrix⁸.

Teatrix was developed as a three-phased application, which was dictated by children’s activities during their dramatic games and story performances, and relies on a theatrical metaphor. The three phases of Teatrix are:

The Backstage phase – in this phase, children have the possibility to choose the scenes, props and characters for each story (similar to what happens in the backstage of a theatre during the preparation of a play).

The On Stage phase – The second step provides the children with the possibility to initiate a story and to start the acting (on stage performance). Children act by means of their characters. In other words, the children perform by directing their characters throughout the story creation process.

⁸ From (Prada et al., 2000).

The Audience phase – The third option is based on the artefact produced from the story creation process. In this phase, children can be the audience of their own performances and watch their previous performances, as being the audience or the public in a theatre (Machado et al., 2000).

Therefore, Teatrix provides the settings and a group of typified characters, following the *functional roles* presented by Propp (1971), but the children are the ones who give life to the characters and write the plot.

This program includes two types of agents: agents controlled by children and autonomous agents (that is, agents whose behaviour is not determined by humans). The “human players” decide the settings and characters to be used from a list of possibilities and, after that those characters play the narrative using three types of actions: communication actions (talk), locomotion actions (walk), and item related actions.

12.2 NLE specificities

Teatrix has the following specificities:

1. this application also promotes **story creation**;
2. the user acts both as a **story observer** and a **story author**;
3. the learning is promoted through **role playing**;
4. Teatrix is embedded in a **3D environment** with **intelligent agents**.

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Appendix A Classification of the considered NLEs within the Four Dimensions

A.1 Knowledge domain:

- **Story creation:** D.Film Moviemaker; Ghostwriter; Kar2ouche Composer; MediaStage; SAM; Story Maker 2; Teatrix.
- **Language learning:** Kar2ouche; MediaStage; Story Maker 2; D.Film Moviemaker; Tactical Language Training System (TLTS).
- **Social competence:** FearNot!
- **Coping strategies:** Carmen's Bright IDEAS (CBI).
- **History and political sciences:** Kar2ouche Composer (with external Content Libraries).
- **Decision making:** Mission Rehearsal Exercise (MRE).

A.2 Role of the user with respect to the story:

- **Story authoring:** D.Film Moviemaker; Kar2ouche Composer; MediaStage; SAM; StoryMaker; Teatrix.
- **Story telling:** Kar2ouche Composer; MediaStage; SAM.
- **Story audiencing:** CBI; FearNot!; SAM; StoryMaker; Teatrix.
- **Story experiencing / participating:** FearNot!; Ghostwriter; MRE; TLTS.

A.3 Learning approach:

- **Challenge-based learning / Game-based learning:** Ghostwriter; MRE; TLTS.
- **Collaborative / Cooperative learning:** Ghostwriter; Teatrix; SAM.
- **Situated Learning / Case-based learning:** D.Film Moviemaker; Kar2ouche Composer; MediaStage; StoryMaker.
- **Role Play:** Ghostwriter; Teatrix.
- **Empathy-driven learning:** CBI; FearNot!.

A.4 Technological means:

- **2D graphics /animations:** CBI; D.Film Moviemaker; Imagine Logo; Kar2ouche Composer; StoryMaker.
- **3D virtual environments:** FearNot!; Ghostwriter; MediaStage; MRE; SAM; TLTS; Teatrix.
- **Tangible interfaces:** SAM.
- **Augmented Reality:** SAM.
- **Intelligent Agents:** CBI; FearNot!; Ghostwriter; MRE; SAM; TLTS; Teatrix.
- **Natural Language Processing:** FearNot!.
- **Speech Recognition and generation:** MRE; SAM; TLTS.
- **Emotion Modelling:** CBI; FearNot!.

For more information on the applications mentioned on this appendix please visit the following web sites:

- Carmen's Bright IDEAS (http://www.isi.edu/isd/carte/proj_parented/);
- D.Film Moviemaker (<http://www.dfilm.com>);
- FearNot! (<http://www.victec.org>);
- Ghostwriter (<http://www.cogsci.ed.ac.uk/~judyr/ghostwriter/>);
- Kar2ouche Composer (http://www.immersiveeducation.com/uk/Kar2ouche_WhatIs.asp);
- MediaStage (http://www.immersiveeducation.com/uk/MediaStage_Default.asp);
- Mission Rehearsal Exercise (Gratch and Marsella, 2001),;
- SAM (<http://www.media.mit.edu/gnl/projects/castlemate/>);
- StoryMaker (<http://www.spasoft.co.uk/storymaker.html>);
- Tactical Language Training System (http://www.isi.edu/isd/carte/proj_tactlang/);
- Teatrix (<http://gaips.inesc-id.pt/teatrix>);

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