



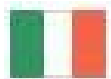
MYSELF European Research Project



**Multimodal eLearning System based on Simulations, Role Playing,
Automatic Coaching and Voice Recognition Interaction for Affective Profiling**

Conference « e-learning : mythes et réalités »

Projet Myself : recherches et réalisations



ACSE

Massimo Balestra

Paolo Franceschini



**«vendredi 16 juin 2006
Site de Sierre, Bâtiment Bellevue, Aula**



HORIZONTAL ACTIVITIES INVOLVING SMES



**Multimodal eLearning System based on Simulations, Role Playing,
Automatic Coaching and Voice Recognition Interaction for Affective Profiling**

Conference « e-learning : mythes et réalités »

Agenda

★ Myself Project Overview –

- ★ - Myself Consortium
- ★ - Project Objectives

Example of Myself Prototype:

- ★ *Simulation, Tutors, Automatic Coaching &*
- ★ *demo on Voice recognition on a Multimodal Graphic Interface*



**Multimodal eLearning System based on Simulations, Role Playing,
Automatic Coaching and Voice Recognition Interaction for Affective Profiling**

Project Overview

Myself is the acronym for “Multimodal eLearning System based on Simulations, Role Playing, Automatic coaching and Voice recognition interaction for affective Profiling”

It is an EC research funded project approved in the first call of the 6° Framework Program

The project started in September 2004 and will finish in August 2006

It is a Craft project- Cooperative research Project - that gathers industries and research performers from six European countries (Italy, Spain, Romania, Switzerland, Poland, Holland)



MYSELF European Research Project



**Multimodal eLearning System based on Simulations, Role Playing,
Automatic Coaching and Voice Recognition Interaction for Affective Profiling**

Project Overview: consortium

CONSORTIUM PARTNERS

RTD		I	ACSE (COORDINATOR)	www.acse.it
		I	MILANO-BICOCCA UNIVERSITY	www.unimib.it
		NL	TWENTE UNIVERSITY	www.to.utwente.nl
		CH	HAUTE ECOLE VALAISANNE	www.hevs.ch
EDUCATIONAL SME		I	LEARNING EDGE (EXPLOITATION)	www.learningedge.it
		E	PREVI - PSICOLOGIA Y REALIDAD VIRTUAL	www.previsl.com
		PL	WARSAW INSTITUTE OF BANKING	www.wib.org.pl
		CH	PLIROSOFT	www.plirossoft.ethz.ch
		CH	CADCAMATION	www.cadcamation.ch
TECHNOLOGICAL SME		I	SDC VOICE	www.sdcvoice.com
		RO	CORNER SOFT TECHNOLOGIES	www.cst.ro
END USERS SUPPORTERS		I	UNICREDIT BANCA S.P.A.	www.unicredit.it
		I	A.S.L. MILANO - AZIENDA SANITARIA LOCALE	www.asl.milano.it



HORIZONTAL ACTIVITIES INVOLVING SMES

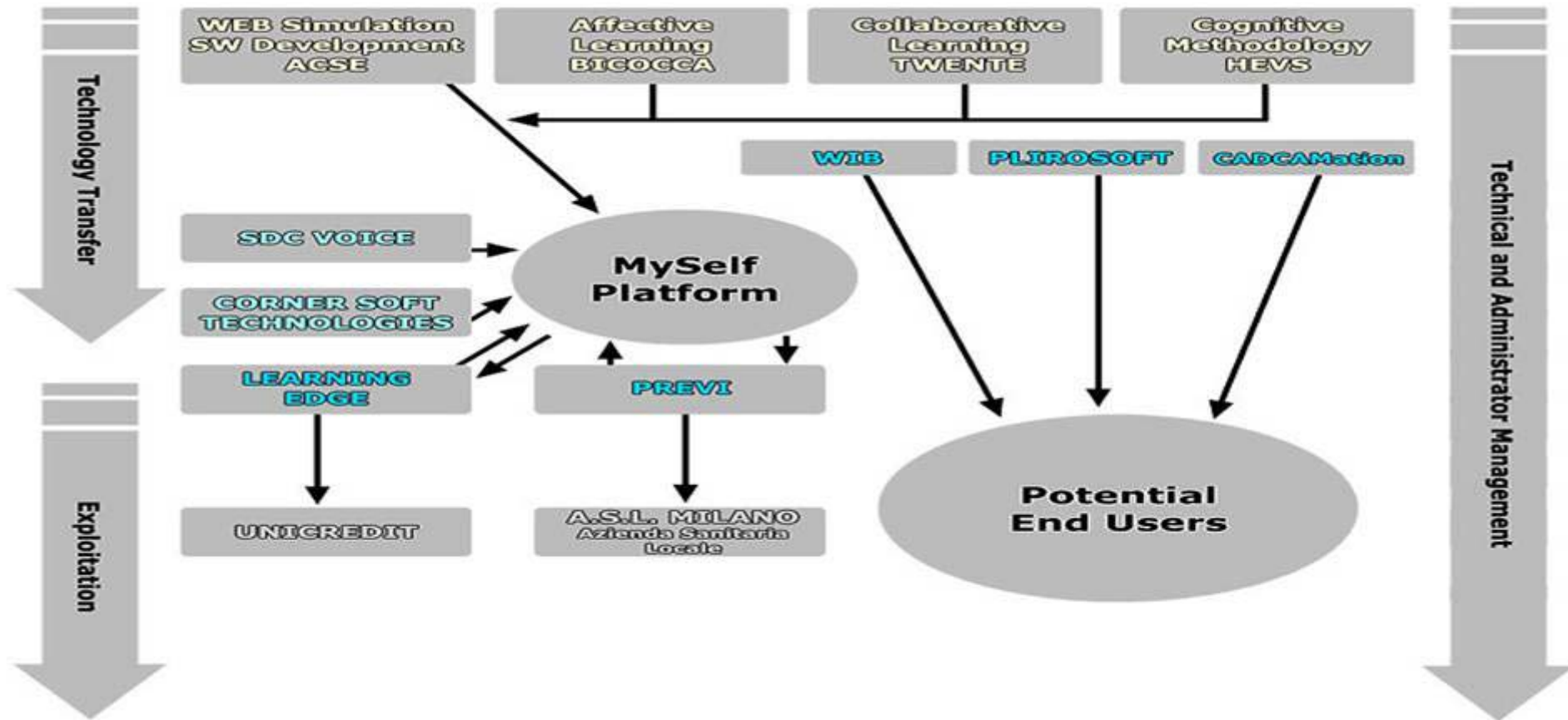


MYSELF European Research Project



Multimodal eLearning System based on Simulations, Role Playing,
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Project Overview: consortium



HORIZONTAL ACTIVITIES INVOLVING SMES



**Multimodal eLearning System based on Simulations, Role Playing,
Automatic Coaching and Voice Recognition Interaction for Affective Profiling**

Project Objectives

The MySelf project is meant to emphasize the experiential training by developing and validating a multimodal learning platform based on vocal recognition, role playing via web and collaborative learning.

The main objective is on the enrichment of the simulations and the affective computing methodologies traditionally carried out in didactic classroom with the recognition of user's emotions through his learning path and systematic distance learning based on Internet

The project is developed concerning two main different targets: the social (Medical field, disabled people) and the profit (Financial field, economical) one.



**Multimodal eLearning System based on Simulations, Role Playing,
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Project Objectives

The Targeted MySelf, in which are implemented the two target profile have the aim of teaching communication skills.

The innovation is based on several scientific and technical meaning:

- 1. Affective Computing, Emotion and learning management (Recognition of Emotional State)**
- 2. Collaborative Learning, Role Playing and Tutoring Agents**
- 3. Cognitive Methodology**
- 4. Speech Processing (Speech Recognition for the Vocal Training)**

Social objectives are related to:

- 1. improving communication skills: improving the learner's (User) skills of self management, MySelf address the self-esteem process related to the growing capability to learn.**
- 2. favouring the intercultural dialogue: for two main aspects, the first is related to a special focus (the intercultural operator) of the target that will be analyzed and implemented in the project: the medical-target.**



**Multimodal eLearning System based on Simulations, Role Playing,
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Myself platform: Multimodality

Below will be showed main SW modules developed in Myself platform.

From an architectural SW point of view the platform, has been thought with high degree of system integration technologies:

- 1. SW has been made by .net Microsoft,**
- 2. Flash from Adobe components,**
- 3. protocol internet for web and voice over IP,**
- 4. integration of Modules for speech recognition**

Multimodality: the prototype platform is already manageable by vocal commands

- 1. Vocal commands that let the SDC-Voice Engine use the MySelf platform commands via voice and via internet, even for disabled people.**
- 2. Vocal commands that interact directly in graphical objects for the simulations: users can identify and refers to graphical objects in the Simulation calling them by voice (calling virtual tutor, calling a choice of the tree-structured Simulations and relative storyboards.)**



Multimodal eLearning System based on Simulations, Role Playing,
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Myself platform: Automatic Coaching on tree structured simulations

The Automatic Matching & Coaching Machine, together with the Affective module are the real kernel of the Myself Platform because they are able to support and manage an important interaction: “Human → Machine”, where a virtual tutor supports the user during his/her training course. The virtual tutor is a 3D graphic representation that can appear on the screen to give information to the user while he/she is executing the simulation.





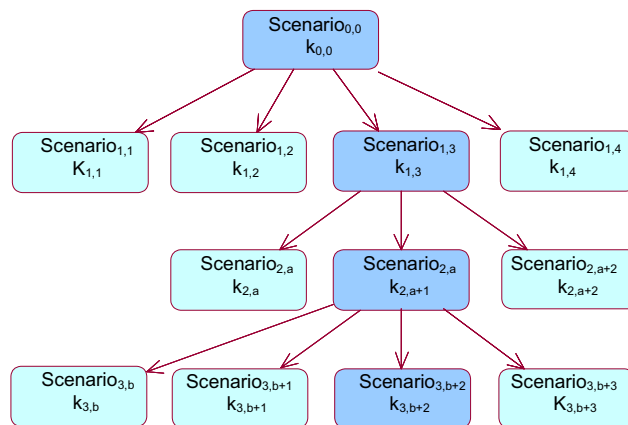
**Multimodal eLearning System based on Simulations, Role Playing,
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Myself platform: Automatic Coaching Engine on simulations

The User perform the first simulation (X) related to the first soft skill and he will be introduced (caused by his choices) in different scenarios;

every scenario has in charge a SCORE that is added to other previous scenarios so to get the Total Score of the Simulation X.

Once terminated the simulation X, the Automatic Coaching Module will introduce the User to a test of Post Assessment aimed at verifying the Total Score gotten by the consumer can be truthful.



To this point the mechanism of Matching compares the Total Score reached by the User with the Ideal Score of Simulation X (this is an information stored in the Database of the Target Profiles)

Depending on the post assessment result, the automatic Module will decide if the User will repeat the same simulation or if he can advance through another Simulation Y



Multimodal eLearning System based on Simulations, Role Playing, Automatic Coaching and Voice Recognition Interaction for Affective Profiling

Myself platform: Pre-Assessment

Before performing the simulation, each user must complete the pre-assessment module that will calculate the appropriate starting score.

Pre-Assessment calculates the score according to the mail skill and sub-skills in order to activate only the simulations required to improve the weakest sub-skill

The screenshot shows a web browser window titled "Myself Assessment Page - Microsoft Internet Explorer". The address bar shows the URL: <http://81.208.113.144/MySelf2005/Medical/Assessment/Assessment.aspx?IDAssessment=11>. The browser's link bar includes "ACSE - Intranet", "Help Desk Rhiag", "MySelf", "Quick Search.exe", "S.A.R.A", "Starguard", "Support.Euro.Dell.Com", "TIM SMS", and "Webcast in Italiano".

The main content area of the browser displays the "MYSELF ENVIRONMENT" header. Below it, a navigation menu on the left lists various sections: HOME PAGE, MEDICAL CONTEXT (with sub-items: COLLABORATIVE, PRE ASSESSMENT, ROLE GAME 1, ROLE GAME 2, ROLE GAME 3, SIMULATION 1, SIMULATION 2, POST ASSESSMENT, EXERCISE 1, EXERCISE 2), BANKING CONTEXT, and OTHER CONTEXT (with sub-items: ADMINISTRATION, TASK LIST, USERS VIEW, GUESTBOOK). The "PRE ASSESSMENT" item is highlighted.

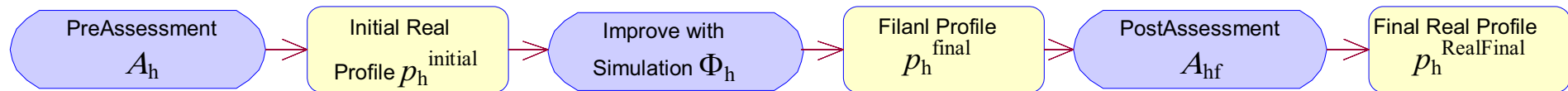
The main content area features a "Medical Pre Assessment" section with a "Question 5 / 10" and a small video thumbnail of a woman. The question text reads: "Chest pain from all except one of the following may be hard to distinguish?". Below the question are three radio button options: 1 acid reflux, 2 diverticulitis, and 3 heart attack.

At the bottom of the page, there is a "Logout" link, a language dropdown menu set to "English", and a "Done" button. The status bar at the bottom of the browser window shows "Internet".



Multimodal eLearning System based on Simulations, Role Playing,
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Myself platform: Automatic Coaching Engine on simulations





Multimodal eLearning System based on Simulations, Role Playing,
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Myself platform: Debrief – Review user choices

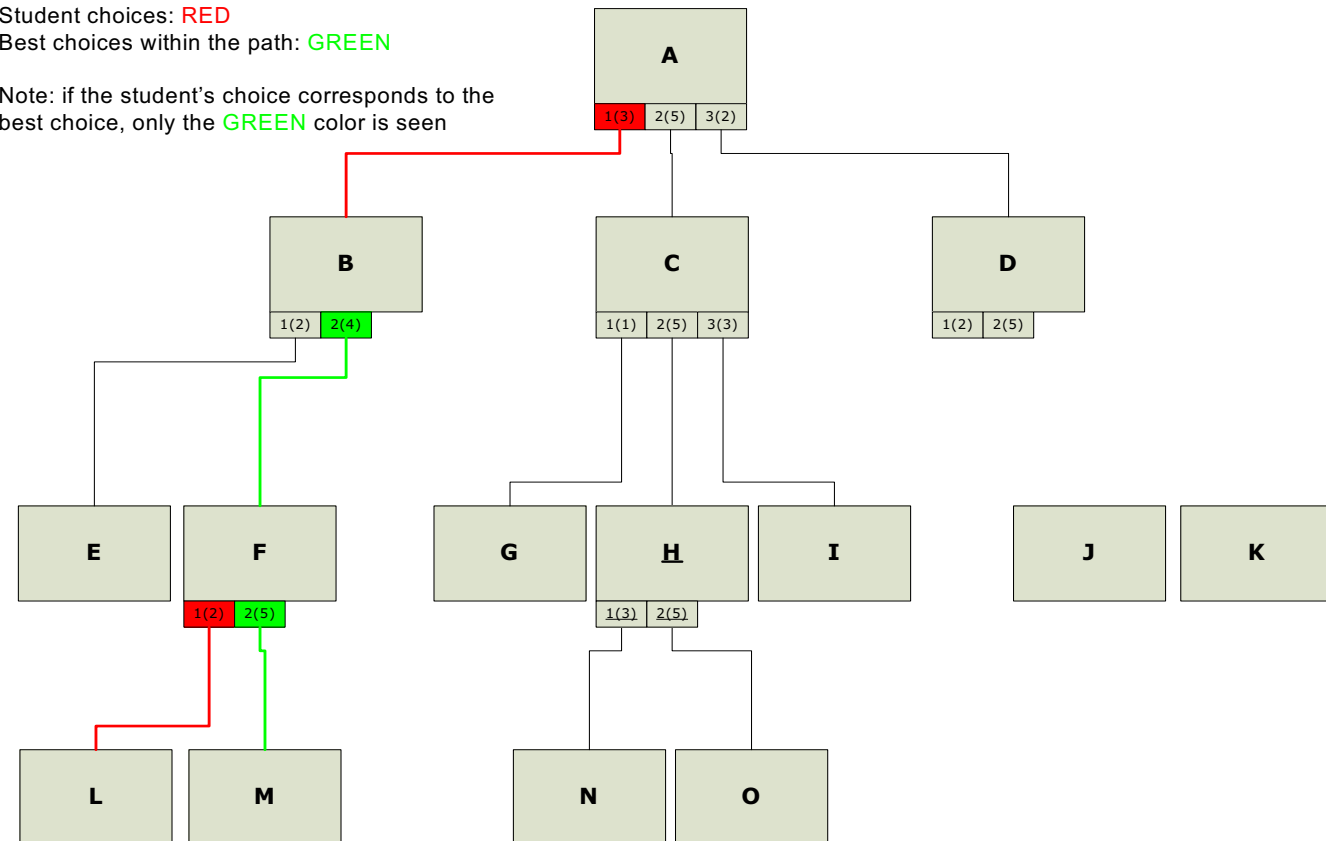
Myself platform provides also simulation review for debriefing and the view of the Best Practice path.

At the end of the simulation the user will have review the choices he previously made (RED PATH) compared to the best available choice at each step (GREEN PATH) with the tutor feedback

Student choices: RED

Best choices within the path: GREEN

Note: if the student's choice corresponds to the best choice, only the GREEN color is seen



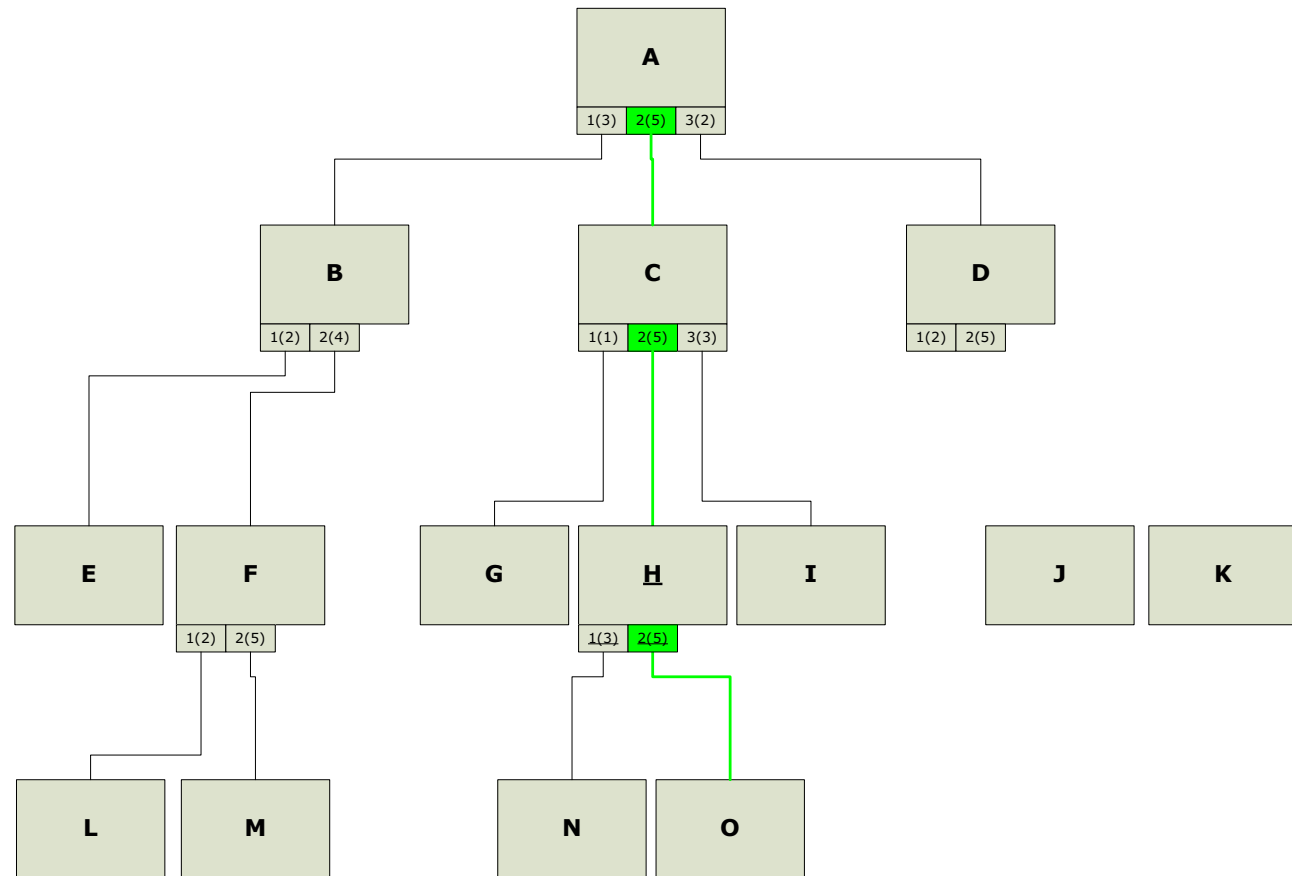


Multimodal eLearning System based on Simulations, Role Playing,
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Myself platform: Debrief – Best Practise

After reviewing his path
the student will be asked
to play again or to see
the Best Practice path.

The Best Practise path is
the BEST PATH that
returns the best
available score





**Multimodal eLearning System based on Simulations, Role Playing,
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Myself platform: Design & Development of 3D interfaces

Myself uses 3D graphics to emphasize the animations, and, in particular two soft wares has been used to build 3D graphical elements of the whole simulations:

1. for 3D virtual reality environment we used Chief Architect by Advanced Relational Technology
2. to recreate all the characters, their movements and their emotions we used Poser by Curious Labs



Chief architect – examples



Poser – examples



Multimodal eLearning System based on Simulations, Role Playing, Automatic Coaching and Voice Recognition Interaction for Affective Profiling

Myself platform: Collaborative Role Playing

Students can play together in a collaborative environment by web connections.

Role playing is based on different type of participants:

•

1. **Students** that are playing the role Game by assuming a specific Role,
2. a **tutor** that can play or assist the students,
3. other students that don't play but assist to the game and to the lessons.

All of them can interact by Web Cam and talk together; no limits on the number of participant to the Collaborative Role playing.

Multilingual approach: Each student can assist or play the Role Game by his own language.

An Italian student will see on his own video the Storyboard in Italian meanwhile the English one will play his own Role in English (each of them will see on their own video the dynamic translation of storyboards).

2. RECOGNITION

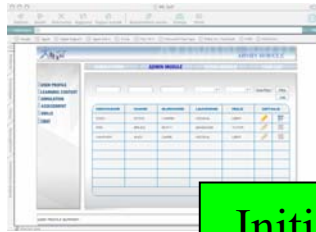
Developing a multimodal emotional recognition system able to provide to the platform information about the emotional and motivational state of the user

Much work has been now carried out in the affective computing domain to perform the **detection and inference of emotional state** from physiological correlates (Prendinger et al., 2004; Scheirer et al., 2002), facial expressions (Chen et al., 1998; Kapoor et al., 2004), vocal-non-verbal features (such as F0, intensity, etc.) (Oudeyer, 2003; Batliner et al., 2003), verbal speech content, questionnaires or self-report measures and the detection of task-related events

NOW: the work is focusing on

- building a **multimodal database** as a background for training and testing algorithms and decision systems
- evaluating **feasibility of implementation** of different channels/modalities in a prospective e-learning applications, according to several key criteria such as technical feasibility, costs, reliability, intrusiveness.
- This system will be coupled by a **cognitive architecture** modelling affect allowing to consistently personalize the learning path according to the user's affective profile and to provide coherent **feedback** to changes of motivational and affective states of the user during the training experience (adapting the path order, difficulty level, conversational interventions tutor, specific activities, ecc.).

MULTIMODAL EMOTION RECOGNITION



Initial user profile

Cognitive architecture and user modelling

Facial Mimics/gestures



Physiological correlates



Vocal non verbal features

Inference on emotional state



SO BOORING...

THAT'S COOL

Verbal speech content

Self-report questionnaires

Task information

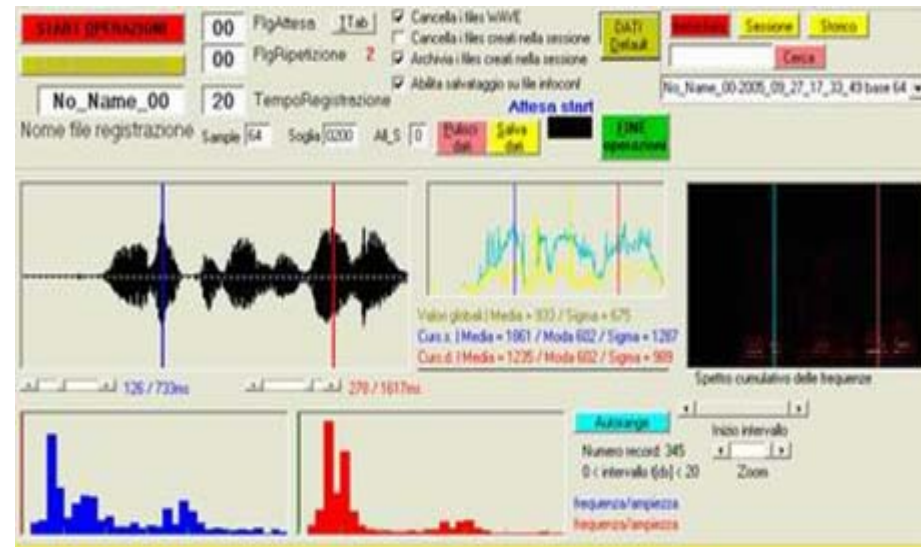


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Myself platform: Affective recognition of The User

The user emotion recognition is realized by Self Report Measurement or through Direct Dialogues between a user and a human tutor, and moreover using a set of Vocal Algorithms able to extract vocal pattern (vocal parameters (time, intensity, frequency, F0.) that are necessary to understand the user's emotional state. The SW development of the SW module, able to measure user vocal parameter, has been developed in this WP and it is in the phase of test.

Tests are in progress to determinate which will the best clustering algorithms to be used to match emotional state. Nearest Neighbor Algorithm and Hidden Markov Models/neural Networks will be used, in parallel also with Fuzzy Logic, to disambiguate and to maximize the % of reliability of user emotion recognition





Multimodal eLearning System based on Simulations, Role Playing, Automatic Coaching and Voice Recognition Interaction for Affective Profiling

```

@relation MyselfEmotionalTS
Header

@attribute MeanF0 real
@attribute MeanF1 real
@attribute MeanF2 real
@attribute MeanNrgDB real
@attribute Length real
@attribute Noise real
@attribute Pause real
@attribute F0Start real
@attribute F0End real
@attribute F0Delta real
@attribute Emotion {Frustrazione, Gioia, Noia, Paura, Rabbia, Tristezza, Neutro, [Undefined]}

@data
275,579,739,59,2.043,2.043,0,227.979,183.8,-44.179,Gioia
173,341,0,44,1.951,1.672,0,279,179.18,189.859,10.679,Noia
288,588,826,58,1.765,1.765,0,307,216.347,-90.653,Paura
250,475,738,56,1.486,1.486,0,224.906,193.762,-31.144,Rabbia
209,391,617,54,2.415,1.765,0.65,204.402,173.572,-30.831,Tristezza
239,407,660,59,1.579,1.579,0,210,172.578,-37.422,Neutro
225,454,629,53,1.672,1.672,0,221,194.556,-26.444,Frustrazione
233,477,724,51,1.672,1.672,0,210,219.524,9.524,Gioia
212,429,642,53,1.765,1.765,0,202.068,201.665,-0.403,Noia
292,553,821,51,1.486,1.486,0,264,222.948,-41.052,Paura
258,511,733,51,1.672,1.672,0,245.412,235.937,-9.474,Rabbia
215,433,622,50,1.579,1.579,0,213.994,192.198,-21.796,Tristezza
231,465,629,53,1.579,1.579,0,221,195.525,-25.475,Neutro
113,237,347,52,2.6,1.95,0.65,103,97.722,-5.278,Frustrazione
201,409,642,56,1.486,1.486,0,132.132,271.95,139.817,Gioia
120,250,355,53,2.415,2.322,0.093,103,97.557,-5.443,Noia
231,467,707,61,1.393,1.393,0,207.979,194.744,-13.234,Paura
197,419,627,64,1.858,1.858,0,146,162.671,16.671,Rabbia

```

Header

structure

Observations

The analysis of the vocal pattern (voice fundamental features) are performed by WEKA Data Mining Software (<http://www.cs.waikato.ac.nz/ml/weka/>).

The training set observations are organizer in a ARFF file (WEKA file format) with the listing of the fields (MeanF0, MeanF1, MeanF2, MeanNrgDB, Length, Noise, Pause, F0Start, F0End, F0Delta, Emotion) and all the observations each identified by the concerning emotion



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ChkVoice v2.0.0006

START OPERAZIONI 05 FigAttesa [Tab] Cancella i files WAVE

Attesa stop = 19 **01** FigRipetizione 1 Cancella i files creati nella sessione

STOP REGISTRAZIONE 30 TempoRegistrazione Archivia i files creati nella sessione

Nome file registrazione Sample 1024 Soglia abs 56 Soglia dB 34,9 Adat. dB = 1 Abilita salvataggio su file infoconf

pippo Freq Min 0006 Freq Max 0127 Sogli Armon 1

Elabora dati **Salva dati** **DATI Default** **FINE operazioni**

mediamodascarto*3
mediamodascarto*3
mediamodascarto*3

Spettro cumulativo delle frequenze

Aurorange Inizio intervallo
#record tempoinistrodestra Zoom
frequenza/ampiezza
frequenza/ampiezza

http://prometeo/myself2005/weka/ - Microsoft Internet Explorer

Address http://prometeo/myself2005/weka/

WEKA Training-Testing Environment on PROMETEO

The "DemoComponent.Class1" DLL-component has been correctly detected on the current machine

Classifier Method: J48

Emotional TRAINING manager

Training Name:

Training Dataset:

Elaboration	WEKA Evaluation Parameters	Elaboration Details
<p>Emotion : Frustrazione 1</p> <p>Perc. 100,00% 0,5000/0,5000</p> <p>Elaborato in 0,8789063 Sec.</p>	<p>Data: 102,206,316,48,2.601,2.601,0, 3</p> <p>Choose the MODEL for the emotional state evaluation: myself-J48-ModelTest01.model</p> <p>One Time Eval <input type="button" value="Eval"/></p> <p>Continuous Eval <input type="button" value="Start Rec & Eval"/> <input type="button" value="Stop Rec"/> <input type="button" value="Clear Log <"/></p> <p>Desktop-View 102,206,316,48,2.601,2.601,0,97.815,89.579,-8.236,? 3 (debug only)</p>	<p>0 Frustrazione 0,5</p> <p>Frustrazione Occurencies :: 1 TotAcc:: 0,500</p> <p>Emotion : Frustrazione</p> <p>Perc. 100,00% 0,5000/0,5000</p> <p>Elaborato in 0,8242188 Sec.</p>

The MySelf Weka Training-Test environment allows to start the recording of the user voice, extract the vocal pattern, send it to the server to be evaluated through Weka



Myself platform: Virtual Tutor

Two Virtual Tutors have been developed that will be the affective mentor during training phase and learning path of the users. The attention has been particularly focused on emotional communication



A first 3D Affective virtual tutor is LINDA (Learning INtelligent Dynamic Agent). The second one will be FABIO. The intervention of the tutor and the modality is strictly bound to the storyboards and skill and emotions to be emphasized

Here are some screenshots of the emotions expressed by the tutor LINDA:



1. EXPRESSION

Design and implementation of a 3D virtual tutor (LINDA) provided with emotional expressive abilities.



Research on human-like pedagogical agents (Lester et al., 1997; Baylor et al., 2000, 2003) and Embodied Conversational Agents (Cassell, 2000; deRosis et al., 2003)

Animation according to results of a preliminary study focused on micro-analysis of a real tutor's facial mimics expressions coded using FACS (Facial Action Coding System) (Ekman & Friesen, 1978, 2002). Special attention was devoted to the multimodality and time synchrony of emotional expression

NOW: we are **currently testing** the effectiveness of Linda's emotional expressiveness and its implications for impression formation in the user throughout the learning experience

NEXT: **design of conversational strategies and modeling of the interaction with the user**; following studies will focus on impact on learning outcome in the long-term