COMPETITION AND INFORMATION: *CUMANA* A WEB SERIOUS GAME FOR EDUCATION IN THE INDUSTRIAL WORLD

Marina Massei, Alberto Tremori
MISS-DIPTEM, University of Genoa
Email {massei, tremori}@itim.unige.it - URL www.itim.unige.it

Alberto Pessina, Federico Tarone
Simulation Team
Email {alberto.pessina, federico.tarone}@simulationteam.com - URL www.simulationteam.com

ABSTRACT

This paper describes *CUMANA*, acronyms for Cooperative/Competitive Utility for Management and Advanced Networking skill Acquisition, a model developed by the Simulation Team for educating the industrial and business communities to operate in a competitive-cooperative environment assigning the proper value to information and sharing data with others players, but with the final goal to win the game considering both individual and common objectives.
CUMANA is an agent driven simulator, distributed via web and based on serious game approach.

Keywords: *agent driven simulation, cooperative-competitive environments, serious game, web simulation*

1. INTRODUCTION

Information and competition: two key-words in our society; from every day life to business and industry it is necessary to deal with enormous amount of information and to use these data in the proper way to compete and success: traffic news for not being late in the office, chose the best product in the supermarket to save money, etc.
This is particularly true in business: a new competitor is coming, problems with failures or delays in production, new potential markets; to identify these emerging phenomena by available information is critical for company success.
In today companies are dealing with many challenges therefore a major question could be summarized as: what is main asset that a modern company need to have to successfully compete in international global markets? Surely there are several answers to this inquiry, but it is possible to summarize most of these concepts within few words: a complex network where knowledge is shared quickly and effectively by flowing information form one node to another one; these nodes are representing both internal and external resources.
So it is critical to support training and education of managers and executives in properly approach information sharing and scenario evaluation over competing/collaborative environment. The paper propose a specific web games that combines Business and Serious Games approaches and apply of Modeling and Simulation (M&S) for this purpose; the solution presented is defined *CUMANA* in reference to the mythological Cumaean Sybil that was a famous prophetess in ancient Rome providing sentences as forecasts of the future that need to be “decrypted” by decision makers; a famous example comes from Sybil sentence “ibi redibis non morieris in bello” given to a warrior moving to the battle: this Latin sentence change radically its meaning by moving the "comma" (by the way, not included in the phrase), in fact the translation could evolve from “you will go and will be back, not dying in war” to “you will go and you will not return, dying in war”; this example demonstrates that the decision makers need to process information carefully in order to take right decisions and this is exactly the case of the *CUMANA* game.
The paper provide an overview on previous similar experiences developed by the authors with agent driven simulation used for web serious games.
The authors propose the detailed description of *CUMANA* model and architecture as well as the results obtained from its early experimentation phases . The obtained results confirm the potential of using *CUMANA* in different areas as well as the opportunity for further developments of this kind of simulators; in fact, the authors are currently completing *CUMANA* developments in order to summarizes related main findings and they are moving forward for activating new researches based on this simulation framework. *CUMANA* is currently available as a Simulation Team resource for experimentation and training (www.mastsrl.eu/solutions/cumana)

2. INDUSTRIAL AND BUSINESS FRAMEWORK

As anticipated a company is in fact an organization that could be represented by a complex network where data are distributed, processed and actions and decisions are make by different entities; this network involve both *internal* and *external nodes*; the *internal nodes* are the different structures, organization, division of a company (see fig. 1); for instance these includes among the others:

- Research and Development;
- Design and Engineering;
- Production;

- Logistics;
- Services and Maintenance;
- Commercial (Sales and Marketing)
- Administration
- Human Resource Management
- Subsidiaries Branches:
    - Commercial;
    - Industrial and Production;
    - Service.

This is particular true for big companies.

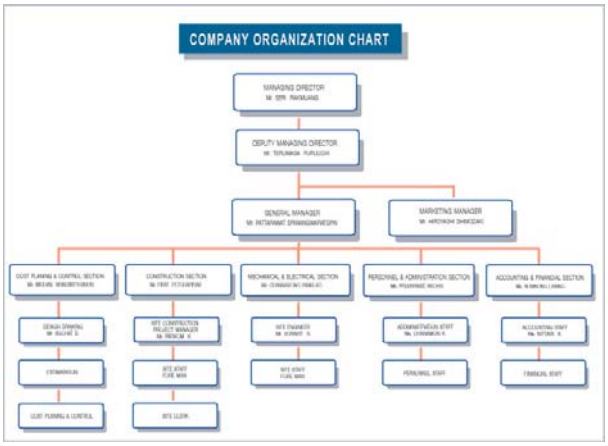

Fig. 1 Sample "Internal Nodes": Company Organization Chart

In addition there are the *external nodes* that are dealing not only with customers or dealers, but even with suppliers, allied companies; in fact today, the presence of a large number of external entities it is very common both for big companies and SME (small and medium enterprises). Among these different kind of external collaborations, not only related to classical commercial activities on markets, it is possible to list among the others the following elements:

- Commercial Agreements;
- Joint ventures,
- Suppliers
- External Service Providers for engineering, installation or maintenance;

In fact, it is possible to consider even all the entities with which there is no kind of hierarchical relationship.
Therefore, in this paper it is presented the researches that have lead to the development of a model that reproduces this kind of Industrial and Business Scenario for educating people to be effective and efficient. The name of the model is *CUMANA*, acronyms for Cooperative/Competitive Utility for Management and Advanced Networking skill Acquisition: it re-creates operative conditions of a day by day activity of different divisions of a big company with new events and problems. The goal is to educate people to face and solve problems in cooperation, without forgetting the specific objective assigned to each individual. For this purposes *CUMANA* has been developed following the approach of combining Business Games and Serious Games: the main idea is that the learning experience is based on playing a game with other players and that this approach support a clear understand of the correct mechanism for operating in the real world. *CUMANA* is a web-based simulation model able to facilitate training of distributed teams.
CUMANA Web Game provides the opportunity to play interactively a cooperative/competitive game, in a distributed environment where different "Managers" operate concurrently with benefits and penalties connected to both common and individual objective achievements related to their role in their Corporation.
The accreditation and the early phases of experimentation of *CUMANA* has been run with the support of different international teams, in fact nowadays, the simulator have been involved in playing games and providing feed backs people from

- Boeing, Seattle (Washington)
- University of Nebraska, Omaha (Nebraska)
- CSC Training Center of Excellence, Orlando (Florida)
- University of Genoa (Italy)
- MAST srl Genoa (Italy)

3. BUSINESS GAMES AND SERIOUS GAMES

A Business Game is a simulation based exercise about company management; in this context the players have to manage a "virtual entity" (i.e. a company or a division) operating in a competitive market. They have to take decisions and to apply methods in order to achieve their goals. It is correct to define it as a game because different players have to compete to achieve usually a common goal and it is based on simulation because it always implies economic models to simulate company and market behaviour (sometime very simple conceptual models, sometime computer simulators).

According to David Kolb *Experiential Learning Model* (Kolb and Fry 1975) the learning process is composed of four main steps (see fig. 2):

1. concrete experience,
2. observation of and reflection on that experience,
3. formation of abstract concepts based upon the reflection,
4. testing the new concepts,

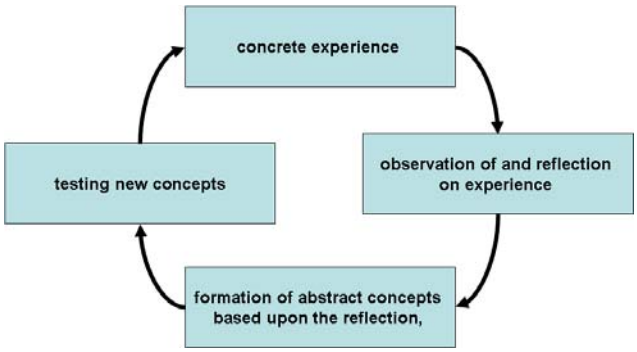

Fig. 2 Kolb Experiential Learning Model

Based on this model, it is clear the importance of business games for management training and/or potential development: they allow to iteratively proceed along all the above mentioned four steps. Business Games are a very powerful tool for developing skills and analytical capacity for decision-making, in knowledge development and also to change individual and personal attitudes. Business Games allow dynamic and active experiential learning reducing risk in the real world operation for new managers that need to face challenges and evolving threats.

An evolution and, at the same time a generalization, of Business Games is represented by Serious Games (Abt., 2002; Michael and Chen, 2005; Bergeron, 2006; Iuppa and Borst, 2006). Based on application of Simulation and new technologies (see fig. 3) they allow to better involvement of users. Serious game is a term used to refer to a software or hardware application developed with game technology and game design principles for a primary purpose other than pure entertainment. Serious games include games used for educational, persuasive, political, or health purposes; often serious games are derived from entertainment computer game engines.

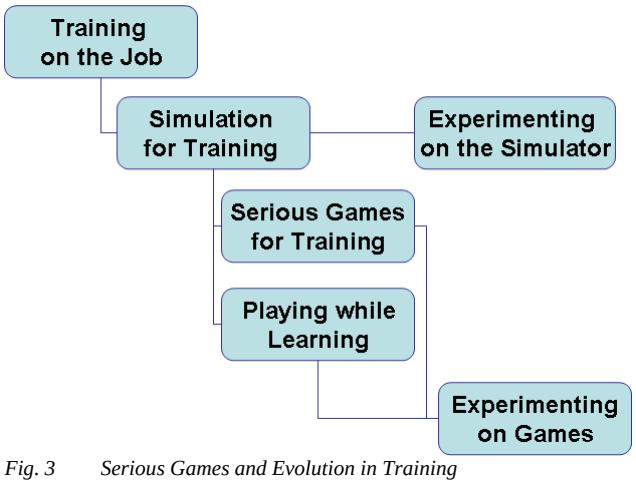

Fig. 3 Serious Games and Evolution in Training

In fact, Serious Games provide an opportunity to improve performances with reduced efforts to professional simulation with great attention to Interfaces, Graphics, Story and Emotional Involvement as well as New Technologies. Obviously the games frameworks to be used in training should be verified and validated in order to guarantee proper fidelity and correct models for avoiding negative training effects; therefore it is critical to define their use focusing on right involvement of the users and on the training objectives.

The potential application areas for these games usually introduce the necessity to add Artificial Intelligence (AI) able to add realism by introducing Human Behaviours; it is common to develop Intelligent Agents (IA) able to drive several of the active entities in the game; in fact this is one of the research areas in which the authors have great experiences as described in the following paragraph.

4. PREVIOUS EXPERIENCES AND EXPERIMENTATIONS

Authors have several experiences in application of M&S in different areas and sectors: Defence, Security, Production, Logistics, ect. (Bruzzone et al. 1998; Bruzzone et al. 2000; Mosca 1994) Among these experiences there are some initiatives that represent a fundamental back ground for *CUMANA* (Bruzzone et al. 2000).

In fact since first middel of ’90 the authors was involved in web games based on modelling and simulation for training applied to homeland and financial security personnel (Mosca et al. 1996); the evolution of web based simulation provided further opportunities to create applications in this area (Bruzzone, Page, Uhrmacher 1999).

A major opportunity to experience these approaches in business was provided by *IEPAL Project (*Elfrey., Bruzzone et al. 2005), acronyms for Intensive Educational Program in Advanced Logistics; this initiative was funded by the US Dep. of Education and by European Community FIPSE. IEPAL was a Transatlantic Educational Program in which several students from different Universities was involved operating both within Academic and Industrial frameworks in Joint International MultiDisciplinary Teams. In fact as the title suggests IEPAL was focused on logistics, but it was an important experience in managing educational packages for distributed, international teams. In the project several international Universities, Research Centers and Companies were involved: among the other Magdeburg University (Germany), Genoa University (Italy), Marseille University (France), Stevens Institute (New Jersey), Boston College (Massachusetts), UCF (Florida), NCS (Company and Agency Consortium for R&D in USA), CFLI (Company Consortium on Logistics in Europe).

Based on this experience, and with the support of several partners involved in IEPAL, in 2008 the authors started a new project for studying impact of new technologies for education. The results of these research was *SIBILLA*, Simulation of an Intelligence Board for Interactive Learning and Lofty Achievements, a web based Serious Game studied for Homeland Security Purposes. *SIBILLA* Game (Bruzzone, Tremori et al. 2009) provides the opportunity to play interactively a collaborative/competitive game, in a distributed environment where different “Intelligence Agencies” operates concurrently with benefits and penalties connected to common and individual objective achievements. *SIBILLA* is multiplayer web strategy game that simulate Terrorist Actions organized by different organization directed by Intelligent Agents that plan, prepare and execute attacks on specific location, site, time and threat type

The development of Intelligent Agents for representing the terrorist behavior *SIBILLA* had benefits form other research projects that the authors carried since the ‘90s in the area of Agent Driven Simulation and Human

Behavior Modelling (Mosca et al. 1995; Avalle et al.1999). In this paper are briefly mention only the following models: ROSES, PIOVRA and IA-CGF.
ROSES (Bruzzone et al., 2003 Bruzzone et al 2004) was developed for the Research Branch of the main Italian Ship Constructor, and it is devoted to create an Oil Spill Simulator, including countermeasure models: in particular the rescue vessels for deploying countermeasure against the spill were totally autonomous and managed by the first generation of Intelligent Agents.

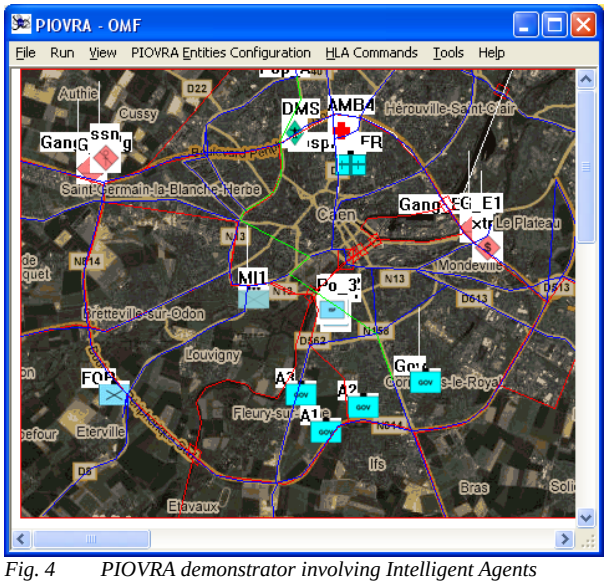

Fig. 4 PIOVRA demonstrator involving Intelligent Agents

In 2001 authors were involved in research in Human Behavior Simulation (Bruzzone 1996, Bruzzone et al., 1998; Bruzzone, Mosca et al., 2001; Bruzzone, Massei et al, 2004;) or reproduction of the Humans by using computer models. Usually this requires to simulate aspects related to Emotions, Rational Thinking, Psychology, Ethology and Sociology with the details required by the specific Modeling & Simulation environment. In 2007 PIOVRA (*Polyfunctional Intelligent Operational Virtual Reality Agents)*, an EDA funded Project involving even Italian and France MoD, was completed (Bruzzone et al.2004; Bocca et al. 2007; Bruzzone, Massei 2007). One of the mail goals of PIOVRA was to develop a new generation of Computer Generated Forces (CGF) able to simulate "Intelligent" and "Autonomous" behavior. PIOVRA CGF demonstrated "Intelligence", in term of co-operative and competitive behaviors (coordinating units both during operative actions and situation evaluation) based on their configuration and nature, the perception of the scenario, order received and Rules of Engagement (ROE). Deliverables (see fig. 4) of this project was a new generation of CGF including human factors interoperating within an HLA Federation and resulting in being re-usable units for other interoperable simulators. In fact after this project the authors involved several entities active in the Simulation Team and developed IA-CGF (Intelligent Agent CGF) a new generation of intelligent agents including special human behaviour libraries, special entities and units as well as non conventional frameworks devoted to simulate specific cases (i.e. earthquakes, civil military cooperation, urban warfare, piracy etc.) (Bruzzone 2008; Bruzzone, Massei 2010). In fact often human factors have a strong impact on Complex System and due to the new advances (including Games) it becomes possible to face this problem: i.e. Behaviour Collection in Massively Multiplayer On-Line Games or web games like *SIBILLA* or *CUMANA*; in fact both simulators get benefits from the use of IA-CGF modules.

5. *CUMANA*: THE SIMULATION MODEL

The *CUMANA* simulator is creating a business scenario with the following educative goals for managers:

- Learning to cooperate with the different players involved in the game by sharing the information received by individual resources in term of:
  - Event Location
  - Event Type
  - Affected Products
  - Affected Company within the Corporation
- Learning to use effectively each info element for taking decisions such as preventive actions to mitigate risks, to maximize opportunities and to avoid a possible future crisis
- To Learn how to properly evaluate the value of available information (directly received and/or shared) in order to share with other players
- Learning to develop trustiness and to estimate and manage reputation while exchanging data and knowledge with other players in respect of individual and common goals
- To develop negotiating skills
-

The general architecture of the game (see fig. 5) is based on the interaction among the different players connected via web and intelligent agents that are managing every critical event and the distribution of information.

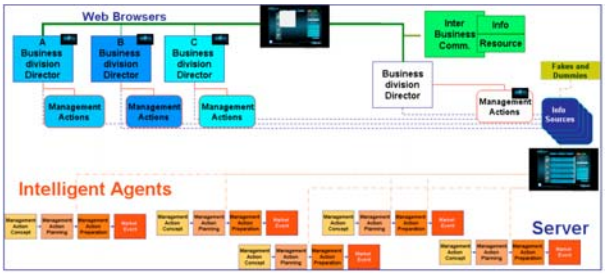

Fig. 5 CUMANA Architecture

In fact *CUMANA* is based on a complex framework of information (see paragraph 5.1) to be distributed among the players based on the stochastic engine and to be received back from players and eventually elaborated and re-used.

The first goal of every player is to forecast critical events on the market. Every event predicted means rise score in the game. For doing that it has been created a simple, but robust, system that creates and direct the events. During simulation execution *CUMANA* takes care of :

- Generating new critical issues: it is randomly assigned to an agent the responsibility of creating and preparing a new critical issue that will arise along time in a critical event (i.e. after n-time); the critical issue and its parameters are randomly generated by Montecarlo techniques; each critical issue need to predicted by players before it is activated
- The agents proceed in planning and preparing the critical event (i.e. launching a new competing product over a geographic region); during their activity, randomly spill of information are generated and distributed among the players; each spill contains a maximum of different bit of information related to this activity usable to predict the incoming event (i.e. where, what, why, who, target), therefore these info are split and distributed among the players partially based on their available resources and on stochastic factors.

For instance we have this event "…a new product will come in the Chinese market, it will have a particularly fancy design that will affected this kind of goods from our company FKKF Paris ltd…". Here below a partial scheme questions/Answers:

Questions	***Answers***
What's happen	New Competitive Product
Which product characteristic is affected	Design
Which geographic area	China
Which company will be attacked	FBKF Paris ltd

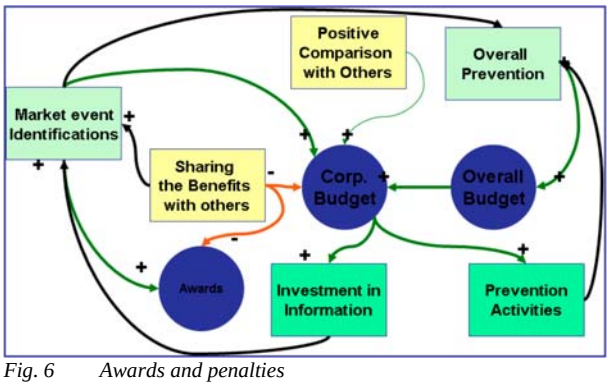

Fig. 6 Awards and penalties

In the flow of information regarding this event are created and distributed also fake information; so every player has some good and some bad data about an event and with this information he has to understand and forecast the whole event.

Usually the first reaction of players is to data mine their data and generate forecasts and actions; therefore the game goal is to educate people to share information to improve the overall performance of the corporation.
A mechanism of awards and penalties has been created and implemented in the system (see firg. 6) to assign awards for prediction and penalties for wrong forecast to individual players as well as to the whole system.

5.1. Information DB Structure

The information are structured in a DataBase (DB), here below a brief description of the logical structure of information (fig. 7).

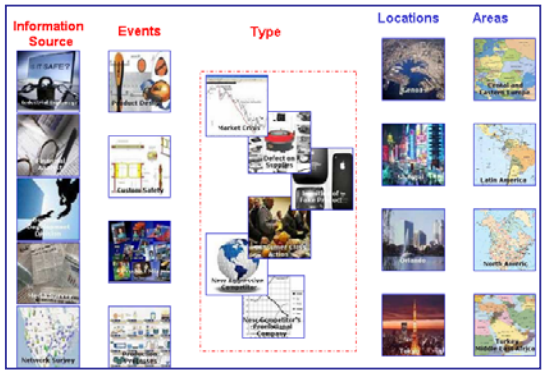

Fig. 7 Structure of Information

- Info Sources: different sources of information are available for players that are entitled to allocate their budget on these source for improving their data collection capability; each source have specific probability to intercept/detect info spill on the critical events; these source includes:
  - Customer Reports
  - Financial Analysts
  - Strategic Consulting
  - Internal Report
  - Network Survey
  - Industrial Espionage
  - Media Survey
  - R&D Division
- Companies: name and probability for every company that can be affected by the critical event
- Company Area: company directorate affected by the event, for instance
  - Product Design
  - Packaging
  - Logistics
  - Quality
  - Service
- Geographic Area: geography area affected:
  - Greater China
  - Asia Pacific
  - North America
  - Latin America
  - Western Europe
- Type of Event: event to be predicted such as:
  - New Competing Product

    - New Competitor's Promotional Campaign
    - Market Crisis
    - Defects on Supplies
    - New Aggressive Competitor
- Event_PL: planning actions carried out by the agents generating spill of information on critical events such as :
    - Meeting
    - Phone Interception
    - Detection Information on Custom
    - Email Interception
    - Web Meeting
    - Teleconference
    - Information Request
    - Creation Business Unit
    - Detection of Business Plan
    - Accessing Information on Product Design
    - Accessing Information on Marketing
- Event_PR: preparation actions carried out by the agents generating spill of information on critical events preparation events such as:
    - Information Stolen from a Company
    - Crisis Trade
    - Economy Trade
    - Computer Security Violation
    - Password Sniffing
    - Suspicious Economy Signal
    - Personnel Abnormal Behaviour
    - Business Plane Disappeared
    - Contract Lost
    - Logistic Information Lost
    - New Logistic Planning
    - New Customs Lows
- Events and Events_1: "support" sheets with all the events generated at system initialization collecting information from all the DB fields (see fig. 8).

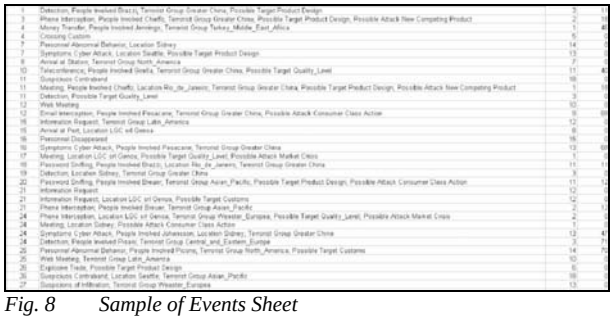

Fig. 8 Sample of Events Sheet

5.2. *CUMANA* Game

CUMANA Game operates by accessing the web within a browser; the *CUMANA* GUI (Graphic User Interface) allows to access a specific game and to play; in fact the server is able to manage multiple games with several players concurrently. In figure 9 it is presented a sample of the of the *CUMANA* desktop. The game include a chat area for sharing info and for their negotiation; in chat it is possible to select what player(s) involve and to arrange money transfer.

Fig.9 CUMANA desktop player

CUMANA provides different frames to use the different resources and manage decision; for instance Prevision Area is where the information are collected for building forecasts; time management in the came could be based on turns or on clock time, the different modes are selected when a new game is initialized; the players need to manage their budget and their cash for allocating resource players.
In figure 10 it is proposed the failure message deliver to player for missing a critical event prediction; this event affect the whole corporation and all player budget are downsized.

Fig. 10 Sample of Missed Prediction Message

Viceversa, figure 11 propose the message for correct critical event prediction; in this case the whole corporation get benefits and all player budget are increased, therefore the overall budget shared evolve to provide a larger slice to the players able to forecast the crisis and prevent it; in this way it emerge a clear individual and common goal for all the *CUMANA* users over a specific game.

6. ACCREDITATION AND EXPERIMENTAL PHASE

Authors have completed a first preliminary experimental phase on *CUMANA* with the involvement of different international subjects. In this paper are summarized the tests conducted in the USA in:

- Boeing, in Seattle Everett (WA)

- University of Nebraska, in Omaha (Nebraska)
- Training Center of Excellence, Lead Associate at CSC in Orlando (Florida)

For every test were played matches for preparation of players and one final match which results were recorded. Personnel from Simulation Team - DIPTEM University of Genoa was directly involved for providing training, tutoring and support during exercises.
The results of Boeing test was also used by the company for evaluation of an international team of young engineers during their internship.
In Table 1 the results of best players are summarized.

Player	Final Score	Successful Forecasts	Forecasts
Player 1	1450	1	1
Player 2	1325	1	1
Player 3	900	0	0
Player 4	750	0	0
Player 5	700	0	1
Player 6	650	0	2
Player 7	525	0	2

Table 1 Final Results Fist test in Company

In the second test a team it was involved a group of Industrial Engineering students of the Last Year from University of Nebraska. It was a numerous team and the test was pretty intensive and required a big effort for tutoring people and collecting information.

Player	Final Score	Successful Forecasts	Forecasts
Player 1	1350	3	3
Player 2	1325	3	4
Player 3	1320	3	4
Player 4	1300	2	5
Player 5	1300	2	7
Player 6	1020	1	5
Player 7	1010	1	4
Player 8	1010	1	6
Player 9	990	1	8
Player 10	965	1	7
Player 11	945	0	2
Player 12	900	0	4
Player 13	800	0	5
Player 14	750	0	6
Player 15	600	0	6
Player 16	555	0	2
Player 17	550	0	6
Player 18	450	0	7
Player 19	425	0	8

Table 2 Final Results second test in University

The last test was made in the Training Center of Excellence, CSC. In CSC the team was a mix people coming from the company and academia,

Fig. 11 Correct Forecast

Player	Finale Score	Successful Forecasts	Forecasts
Player 1	1020	1	1
Player 2	990	0	1
Player 3	900	0	0
Player 4	880	0	0
Player 5	860	0	0

Table 3 Final Results of third test in Training Center

At the end of every test a questionnaire was completed by participants here below the average results.

Question	Vote
Quality of GUI (0 very bad – 10 excellent)	9,3
Usability (0 very bad – 10 excellent)	8,6
SW Speediness (0 very bad – 10 excellent)	6,6
Difficulties (0 no difficulties – 10 impossible)	2,0
Training Objective (0 very bad – 10 excellent)	8,8
General Vote (0 very bad – 10 excellent)	8,8

Table 4: average results from participants

In fact, despite the limited number of people used in these tests and the preliminary nature of this experimentation, the evaluation of *CUMANA* results very satisfactory. A lot of comments were also collected about duration of games or about the impact of this tool for educational purposes.
Authors are completing further analysis at the University of Genoa with the support of Italian companies and there are undergoing new tests for completing the evaluation phase of *CUMANA* and for improving the educational and training capabilities of this framework.

7. GAME USE AND FUTURE DEVELOPMENT

In fact, different evolutions and improvements of *CUMANA* are under investigation. For instance the Authors are studying the possibility to uses *CUMANA*, but also *SIBILLA*, in multi-scenario and multi-level games: an example of multi-scenario could be represented by “horizontal” concurrent games with both cooperative and competitive approaches in different Regions (see Fig. 12). Another possible extension in the use of *CUMANA* over a “vertical” approach with the

creation of chains of command / company multilayer organizations where different players or teams act as different hierarchical levels within a corporation exchanging information among the different levels and the different divisions. A combined approach of the two above described modes is also possible and could be studied and adopted in the future.
Other improvements of this family of Serious Games are under evaluation; in fact the authors are planning new researches to improve emphatic involvement of the player: it is very important to remember that this is one of the key success factor for serious games being the efforts of the users strongly motivated by these aspects that could maximize the educational impact of the games. Other tests are also under evaluation considering the collaboration of different user communities both in geographical and cultural matter. Very close to this concept the idea of using *CUMANA*, but *SIBILLA* as well, as experimental labs for other models. There are also possible developments related to authors' research tracks on Intelligent Agents and Human Modelling with new improvement on the autonomous behavior of entities generating events.

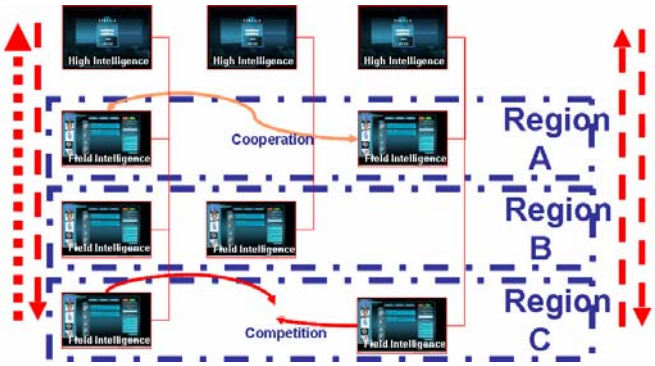

Fig. 12 Multi Level and Multi Scenario Games

On a more technological side there are future ideas of integrating *CUMANA* with Synthetic Environments or other multimedia content (video streaming, audio…) to improve realism of the game; special attention will be devoted to combine these games with Mobile solution using smart phones; in fact with currently technology, it is possible to develop new releases of this game engine for mobile applications such as for smart phones or PDAs for new improvement in the game (i.e. the multilevel approach described above)

8. CONCLUSIONS

This paper described the use of an agent driven, web simulator that applying theories of serious games for education and training of businessmen and managers; the main goal is to transfer skills in understanding the value of information and to transfer the concept that sharing data with colleagues empowers the system.
CUMANA has been developed based on several previous experiences of the authors in the industrial sector on the use of M&S in training and education and in the development of Serious Games and Agent Driven Simulators. Authors used great attention first of all in the creation of the conceptual models that could represent the complexity of an extended enterprise with different areas and directorate and with operations over different geographies. The development of the game engine presented on the other hand difficulties due to the choice of a web distributed application and with the strategic goal of a tool that could be used form people behaving to different cultures, both from an academic or applicative and a international point of view. The first experimental phase showed good results form users and authors are using data from these international and multi-disciplinary tests for completing analysis of results of the use of this innovative kind of systems for education purposes. New tests are also under evaluation at Simulation Team and in cooperation with MISS DIPTEM in the University of Genoa and in collaboration with industrial partners. The authors are currently involved in several extension of these models considering the great potential of the proposed approach and the results provided by *CUMANA* simulator.

ACKNOWLEDGEMENT

The authors thanks Mike McGinnis, Judith Converso and Roberto Lu and their institutions and organizations for their support and availability in the preliminary experimentation phase of the project.

REFERENCES

- Abt C.C., (2002) "Serious Games", University Press of America
- Argryis, C. (1958) "Some Problems in Conceptualizing Organizational Climate: A Case Study of a Bank", Administrative Science Quarterly, 2, 4, pp.501-20
- Avalle L, A.G. Bruzzone, F. Copello, A. Guerci, P.Bartoletti (1999) "Epidemic Diffusion Simulation Relative to Movements of a Population that Acts on the Territory: Bio-Dynamic Comments and Evaluations", Proc. of WMC99, San Francisco, January
- Axelrod R. (1981) "The Emergence of Cooperation among Egoists." American Political Science Review 75 (June): 306–18
- Bergeron B, (2006) "Developing Serious Games", Charles River Media
- Bennis, W. (2002). Nobody in Charge: Essays on the Future of Leadership Jossey-Bass.
- Bavelas, A. (1950) "Communication Patterns in Task-Oriented Groups", Journal of the Acoustical Society of America, vol. 22, issue 6, p. 725
- Bocca E., Pierfederici, B.E. (2007) "Intelligent agents for moving and operating Computer Generated Forces" Proc. of SCSC, San Diego July
- Bruzzone A.G. (1996) "Object Oriented Modelling to Study Individual Human Behaviour in the Work Environment: a Medical Testing Laboratory ", Proc. of WMC'96, San Diego, January

- Bruzzone A.G., Giribone P. (1998) "Quality Service Improvement by Using Human Behaviour Simulation", Proc.of ESM98, Manchester UK, June
- Bruzzone A.G. M.E. (1998) "Upgrading Civil Protection Systems: The impact of New Techniques on Emergency Management Training", Proceedings ITEC98, Lausanne, Apri 28-30
- Bruzzone A.G., Page E., Uhrmacher A. (1999) "Web-based Modelling & Simulation", SCS International, San Francisco, ISBN 1-56555-156-7
- Bruzzone A.G., Vio F., Capasso S. (2000) "MOSLES: Modelling & Simulation for Transport and Logistic Educatonal Support", Proceedings ITEC2000, The Hague, April
- Bruzzone A.G., Mosca R., B.M., B.C., Spirito F., Coppa A.C.M. (2001) "Advanced Modeling for Customer Behaviour Analysis ", Proceedings of MIC2001, Innsbruck Austria, February
- Bruzzone A.G., Mosca R. (2003) "Modelling & Applied Simulation", DIPTEM Press, Genoa, ISBN 88-900732-3-3 (197pp)
- Bruzzone A.G, Orsoni A., Giribone P. (2003) "Fuzzy and Simulation Based Techniques for Industrial Safety And Risk Assesment", Proceedings of ICPR, Blacksburg VA USA, August 3-7
- Bruzzone A.G., Viazzo S., B.C., Massei M. (2004) "Modelling Human Behaviour in Industrial Facilities & Business Processes", Proc. of ASTC2004, Arlington, VA, April
- Bruzzone A.G., Massei M., Simeoni S., Carini D., B.M. (2004) "Parameter Tuning in Modelling Human Behaviours by Using Optimization Techniques", Proceedings of ESM2004, Magdeburg, Germany, June
- Bruzzone A.G., Figini F. (2004) "Modelling Human Behaviour in Chemical Facilities and Oil Platforms", Proceedings of SCSC2004, San Jose'
- Bruzzone A.G., Petrova P., B.M., B.C. (2004) "Poly-functional Intelligent Agents for Computer Generated Forces", Proceedings of Wintersim2004, Washington DC, December
- Bruzzone A.G., Williams E.(2005) "Summer Computer Simulation Conference", SCS International, San Diego
- Bruzzone A.G., (2007) "Challenges and Opportunities for Human Behaviour Modelling in Applied Simulation", Keynote Speech at Applied Simulation and Modelling, Palma de Mallorca
- Bruzzone A.G., Massei M. (2007) "Polyfunctional Intelligent Operational Virtual Reality Agent: PIOVRA Final Report", EDA Technical Report, Genoa
- Bruzzone A.G. (2008) "Intelligent Agents for Computer Generated Forces", Invited Speech at Gesi User Workshop, Wien, Italy, October 16-17
- Bruzzone A.G., A. Tremori (2008)"Safety & Security in Retail: Modeling Value Chain Dynamics "Proceedings Of BIS2008, April 14 - 17, 2008, Ottawa, Canada
- Bruzzone A.G., Elfrey P.,Cunha G., Tremori A. (2009)“Simulation for Education in Resource Management in Homeland Security” Proceedings of SCSC2009, Istanbul, Turkey, July
- Bruzzone A.G. (2009) " Intelligence and Security as a Framework for Applying Serious Games", Proceedings of Serixgame, Civitavecchia, November
- Bruzzone A.G., Massei M. (2010) "Intelligent Agents for Modelling Country Reconstruction Operation", Proceedings of AfricaMS 2010, Gaborone, Botswana, September 6-8
- Cartwright D, Zander A. (1960) "Group dynamics: Research & theory", Tavistock, 1960, London
- Computer Science and Telecommunications Board-US National Research Council (1977) "Modeling and Simulation: Linking Entertainment and Defense", *National Academy Press*,
- Elfrey P. (1982) "The Hidden Agenda", Wiley & Sons, NYC
- Elfrey P., Bruzzone A.G., R.Mosca, A.Naamane, C. Frydman, N.Giambiasi, G.Neumann, D.Ziems, S.Capasso, R.Signorile, S.Ghosh, A.Nisanci, B.C.B.M. (2001) "Logistics & Education In IEPAL International Cooperation", Proceedings of HMS2001, Marseille October 15-17
- Iuppa N, Borst T, (2006) "Story and Simulations for Serious Games: Tales from the Trenches" Focal Press
- Kolb. D. A. and Fry, R. (1975) Toward an applied theory of experiential learning. in C. Cooper (ed.) Theories of Group Process, London: John Wiley
- Michael D, Chen S, (2005) "Serious Games: Games That Educate, Train, and Inform " Course Technology PTR
- Moreno J.L. (1947) "The Theatre of Spontaneity", Beacon House, NYC
- Mosca R., Giribone P. & Bruzzone A.G. (1994) "Simulation & Automatic Parking in a Training System for Terminal Container Yard Management", Proceedings of ITEC94, The Hague, April 26-28
- Mosca R., Giribone P. & A.G.Bruzzone (1995) "AI Techniques to Optimize the distribution of Fire-Fighting Squads during an Accident", Proc. of Simulators International XII, Phoenix, April 9-13
- Mosca R., Bruzzone A.G. & Costa S. (1996) "Simulation as a Support for Training Personnel in Security Procedures", Proc. of Military Government and Aerospace Simulation, New Orleans LA, April 8-11
- Nylen D., Mitchell J.R., Stout A.T. (1967) "Handbook of staff development and human relations training: materials developed for use in Africa", NTL Institute for Applied Behavioral Science, Washington D.C.