

CHAPTER X

USING ONLINE ROLE-PLAYING GAMES FOR ENTREPRENEURSHIP TRAINING

ALFIE KEARY, PAUL WALSH,
DEIRDRE O'BYRNE, JONATHAN
MOIZER, JONATHAN LEAN, ANDREA DI
FERDINANDO, ORAZIO MIGLINO, RALF
FRIEDRICH, ROBERTA ASPERGES, LIZ
THOMSON, ELENA DELL'AQUILA,
LUIGIA SIMONA SICA

Purpose and objectives of chapter

This chapter presents a case study and research analysis of the use of educational multi-player online role play games for soft skills training to promote and develop more effective entrepreneurship across social enterprises (SEs). The chapter opens with an outline of the research deliverables of the European S-Cube project in serious games technologies. This is followed by a contextual overview of the social enterprise sector across three European Union (EU) partner countries and the role S-Cube is expected to play in game-based learning (GBL). Sections three and four present S-Cube as an entrepreneurial training agent and presents an overview of the main features of the game and how soft skills training scenarios can be easily developed, deployed and peer reviewed by a trainer.

Section five has a short overview of the S-Cube's underlying technologies and is followed by a discussion and analysis of quantitative and qualitative data from two phases of software trials that took place

across Europe in 2013. The chapter concludes with a review of the research findings from the S-Cube project and also presents a proposal on future developments and innovation. In particular the chapter discusses how a game based learning platform such as S-Cube could be reengineered to incorporate affective and perceptive computing technologies and functionality.

S-Cube project, partners and background

This section discusses what a social enterprise is, introduces the S-Cube project and provides a brief overview of the resulting S-Cube Educational-Multi-player Online Role Play Game (E-MORPG).

What is a social enterprise (SE)

Increasingly in almost all industrialised countries, we have seen the remarkable emergence of a new type of socio-economic model of business, the social enterprise. In the 1970s, with increased unemployment and falls in economic growth across Europe, many states experienced crisis. Retrenchment followed, which was often characterised by privatisation and a stark reduction in spending on public services provision by governments (Mosher-Williams, 2006; Borgaza & Defourny, 2001; Borgaza & Santuari, 2003). This situation led to an unprecedented rise in the development of social enterprises to help meet this inadequacy in social needs provision and rising unemployment. These enterprises were mainly established by civil society or third sector organisations and groupings (Nyssens & Kerlin, 2005). They included a wide array of initiatives focused on such areas as childcare, employment programmes for the unemployed, care for elderly people and social information provision.

In understanding the concept of social enterprises, it is therefore important to understand what has become known as the *third sector*. National economies are considered to have three sectors. The first sector is the private sector which is centred on profits for private purposes and the second sector (the public sector) is overseen by governments. However, national economies have a third sector that doesn't fit into either of the preceding categories and is also seen as part of what is known as the social economy. The social economy pursues social goals and provides services

and goods by using market economy strategies. The origin of the S-Cube project lies in addressing the needs of social enterprises in the *third sector*.

Ridley-Duff & Bull (2011) discuss how soft skills allow people to manage social enterprises and are the key to “strategic management and planning”. The authors illustrate that any successful social enterprise will have to manage a “balance” across all its four broad areas of management:

- “Return, multiple bottom line”: From budgeting, social value, measurement, social accounting through to sustainability.
- Internal Activities: From communication structure, quality systems, flexibility through performance.
- Stakeholder: From focusing on stakeholder needs, sector knowledge, image and branding, promotion, budgeting, through to evaluation.
- Learning: From training and development, team working and participating, knowledge, culture, leadership, through to continuous improvement.”

(Ridley-Duff & Bull 2011).

As further justification, soft skills development has been recommended by the European Parliament and Council as intrinsic, not alone to effective learning, but equally to the development of innovation and as a strong spur to employment growth. An EU Parliament report states a key objective for the future is to: “identify and define the key competences necessary for personal fulfilment, active citizenship, social cohesion and employability in a knowledge society” (European Parliament and Council, 2006, p.3).

S-Cube project background

S-Cube is a European Commission (EC) funded ‘Leonardo Da Vinci Transfer of Innovation’ project titled ‘Using Online Role Play to Promote Soft Skills Development for Social Enterprises’. The S-Cube project represents the collaboration of four transnational EU education and training providers; Plymouth University (UK); Cork Institute of Technology (Ireland); UNINA (Naples, Italy) and GeProS (Germany).

The name S-Cube represents the three S's associated with this project, namely: **Soft Skills for Social Enterprises**. The S-Cube development

project secured EU Leonardo Transfer of Innovation Funding in January 2011 to create an e-learning tool to support the development of soft skills for social enterprises and was completed during the period January 2012 to December 2013. The overall mission of the S-Cube project was to spread the use of online learning (through open source provision) as a way of providing a training experience to enhance the soft skills of individuals working within social enterprise settings.

S-Cube Educational-Multi-player Online Role Play Game (E-MORPG)

S-Cube represents the current development of a specific game-based learning platform developed using EUTOPIA. EUTOPIA is a platform that originated from a previous Information and Communication Technology project: SISINE, developed by the Natural and Artificial Cognition Laboratory. SISINE (Miglino, 2007) was used to provide innovative training practices and to improve negotiating skills and intercultural awareness of professional trainers, front office staff and other staff in contact with the public.

The training methodology was based on a blended strategy, combining classroom learning with e-learning based self-study. Both the classroom learning and the self-study sessions made intensive use of a novel simulation environment. The simulation environment incorporated technologies from Multiplayer Online Role Playing Games (MORPG) (Okamoto, et al., 2007). EUTOPIA is an online platform that allows for the production of a particular type of serious game: (in this case S-Cube) which is referred to as an Educational Multiplayer Online Role Playing Game (E-MORPG).

From the formative teaching side, EUTOPIA was engineered to enable the transfer of the methodological tradition of the psychodrama (Moreno, 1946) from the real world into a three dimensional (3D) virtual world. According to the Birmingham Institute of Psychodrama website a “psychodrama is a method of psychotherapy in which people are helped to actively explore situations from their own life, past, present and future” (Birmingham Institute of Psychodrama, 2014). Therapeutic aspects of psychodrama incorporates “sensitively guided facilitation with participants being helped to examine areas of concern, better understand themselves and their history, resolve loss and trauma, overcome fears, improve their

relationships, express and integrate blocked thoughts and emotions, practise new skills or prepare for the future” (Birmingham Institute of Psychodrama, 2014).

EUTOPIA incorporates the underlying psychodrama process discussed above with players being represented as avatars in a 3D interactive world. It also provides the normal functionality expected of a MORPG (Madani & Chohra, 2008), incorporating capabilities to assume various roles established and mediated by human or artificial agents (avatars) endowed with specific physical and emotional features. Users can also use multiple choice options and play different roles and interact with different avatars. Additional features added to the platform provide functions that allow a trainer (*trained psychodramatist*) to set up games, intervene during the game, record specific phases of a game, annotate recordings and discuss aspects of the role play with the players. Figure x-1 below provides a graphic on the player user interface in S-Cube that has been built using the EUTOPIA platform.

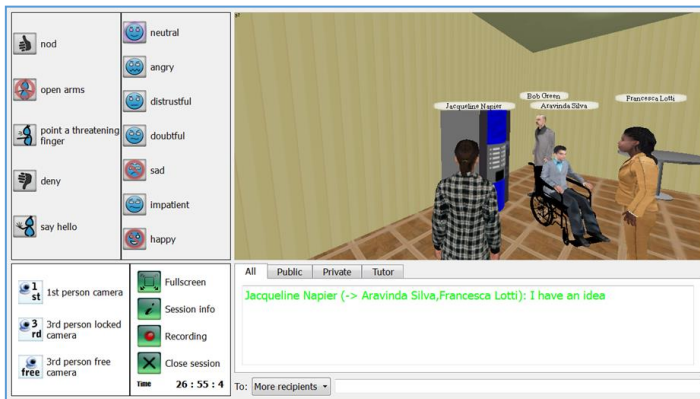


Figure x-1.– S-Cube player user interface

This section introduced the social enterprise and the importance of soft skills for the sector. It also provided the background to the EU-funded S-Cube project and presented an overview of the E-MORPG platform.

S-Cube justifications

This section presents some of the background research that was conducted in relation to the evaluation of soft skills needs at SEs. Qualitative and quantitative research was conducted that led to the identification of key skills gaps across SEs. The section discusses the main types of soft skills required and the preferred methods of training delivery at SEs. The wider application potential of the S-Cube is also discussed.

Quantitative and qualitative research

To inform the design and development of the S-Cube learning programme for soft skills development for social entrepreneurs, a systematic investigation and analysis of the training needs of social enterprises was conducted across three partner areas; the UK, Ireland and Germany. The S-Cube training needs analysis (TNA) research was designed to identify and categorise the soft skill needs of a range of social enterprises and was inclusive of other social enterprise stakeholders such as educators, trainers and support organisations. The findings of the TNA have been used to inform the design of a competency model for assessing these identified soft skills.

Through a structured methodology, the TNA sought to:

- identify the gap between current perceived existing levels of soft skills within social enterprises and the perceived levels of importance of those same soft skills within the enterprises to increase competitiveness and success in the business and social fields in which they operate.
- identify the levels of training that was needed to close any soft skill shortfalls.
- discover and decide upon appropriate approaches and methodologies of training delivery that best meet and suit the soft skill training needs of potential users of the S-Cube learning programme.

Training Needs Analysis (TNA) outcomes

The overall results of the scoping interviews in the main mirrored the results for the three clusters (three project partner areas) examined. The results established in two of the clusters (Ireland and the UK) indicated that “communication” and “effective leadership” ranked highest in terms of importance/usefulness within social enterprises. It was also found that these two soft skills were very significantly under-represented within social enterprises, despite the expression by staff of their overwhelming importance. A similar differential was also discovered in relation to four other soft skills: Decision making; Strategic thinking; Conflict resolution and Judgement. In addition to the scoping interviews, an online survey was conducted across the partner regions to trawl further views on the training needs of a wider number of social entrepreneurs in relation to soft skills. A total of 134 responses to the survey were received across the three participating countries.

SE research - soft skills key requirements

A full discussion on the TNA is outside the scope of this chapter but the two graphics below provide an insight into the “communication skills” requirements of social enterprises. The graphics critically identify a gap between the importance of communication skills (figure x-2) and the perceived level of communications skills (figure x-3) at existing SEs.

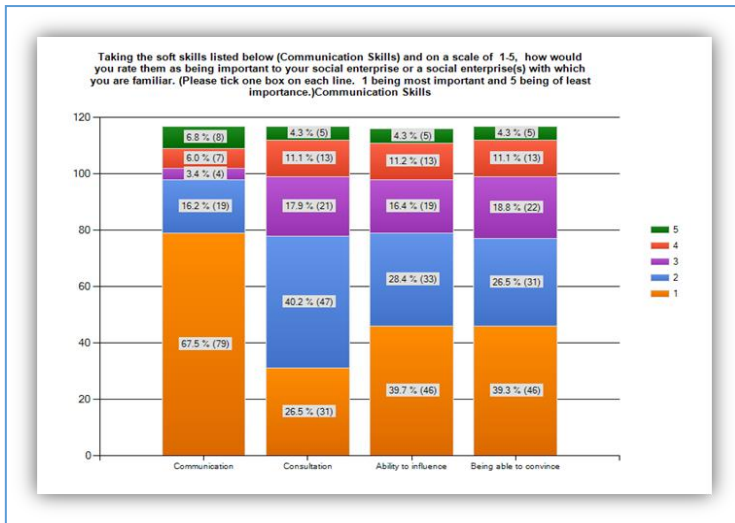


Figure x-2: Communication skills - Importance rating

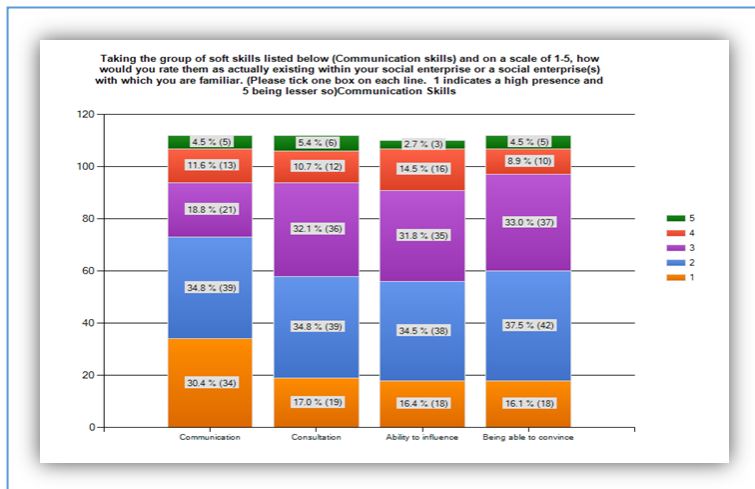


Figure x-3: Communication skills - Perceived levels of existence in social enterprises

SE training and learning delivery

A further outcome of the TNA relates to the preferred training delivery methods. When given a choice of how training would be delivered it was found that most respondents (76.5%) preferred a combination of all three options; e-learning, workshops and tutorials. The two graphics below (figures x-4 and x05) provide indicators in relation to the role of computer games and more specifically role-play games for soft-skills learning and development.

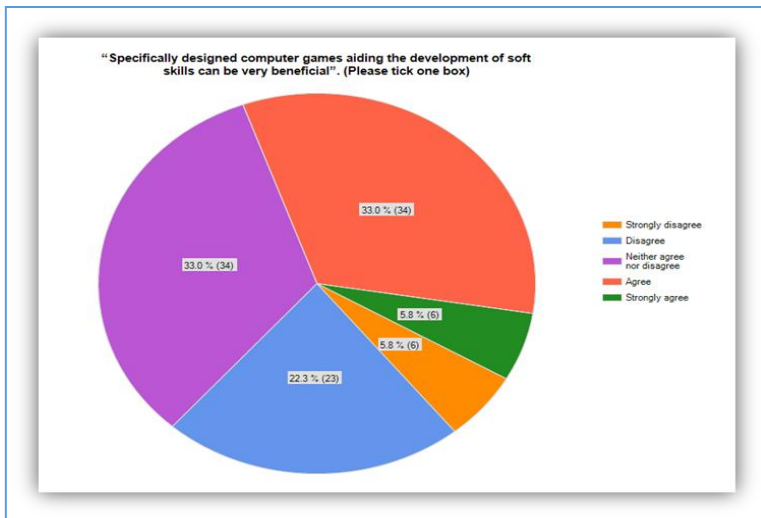


Figure x-4: Computer games and soft skills

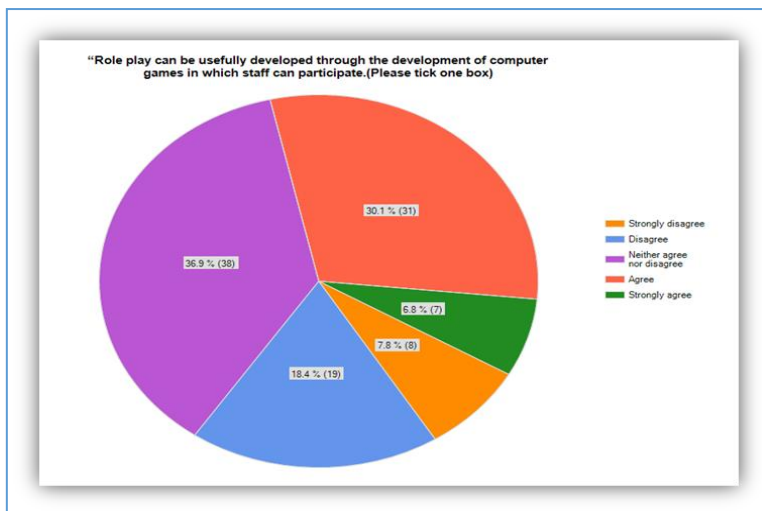


Figure x-5: Role play computer games learning for staff of social enterprises

The results of the scoping interviews and online survey informed the focus of the S-Cube learning programme and assisted in defining the parameters of a game scenario titled *Future Positive* that was developed for subsequent trialling with SE stakeholders. *Future Positive* is an S-Cube role play game that involves players in a 3D virtual world environment addressing and solving a business problem using their soft skills expertise. The purpose of the *Future Positive* game scenario is to provide participants with the opportunity to take part in a role play exercise focused on the use of entrepreneurial communication skills, particularly those of persuasion and influence.

The TNA conducted as part of the S-Cube project identified that soft skills relating to the following areas were rated as being “important” or “very important” by a large proportion of respondents from social enterprises: communication (83.7%), consultation (66.7%), ability to influence (68.1%), and ability to convince (65.8%). However, existing skills in these areas were rated to be low. Therefore, the *Future Positive* scenario that has been developed aims to provide an opportunity for participants to develop key communication skills from a social enterprise perspective.

The overall results of the TNA produced a base line of information, systematically and empirically constructed which served to inform the design and development of the S-Cube. Further details and comprehensive TNA analysis is available in O'Byrne et al. 2013.

Wider applications of S-Cube

While the core focus of the S-Cube has been around the soft-skills training needs of social enterprises, the S-Cube also has wider application. The S-Cube may be used to develop any number of communications/enterprise skills scenarios that could be used across all three sectors in an economy. To date the S-Cube provides a number of games scenarios to develop entrepreneurial soft skills for business venture formation, closing sales, financial deals, problem resolution and recruiting business support. The S-Cube has also been recognised by an international company as having potential for use on one of its corporate social responsibility (CSR) programmes on cyberbullying.

S-Cube for soft-skills and entrepreneurial training (player perspective)

The S-Cube EUTOPIA powered software includes features for trainers and players. The trainer controls allow for the creation of offline and online multiplayer games; intervening during games and management of debriefing sessions. The features for players allow them to participate in multiplayer games and in debriefing sessions. The platform also provides additional facilities specially designed to enable its use in distance learning. Some of the key features and functions from a player's perspective are described in this section.

S-Cube game organisation and scenarios

The S-Cube game scenario is developed by the trainer and will be discussed in the next section. Once the game scenario (*such as Future Positive*) is loaded into the S-Cube, players log on and start to interact with

the game. Once a player enters the game a session information window appears that will show four kinds of information:

- **Introduction:** Introductory description of the session;
- **Main:** Title, session description and general goals of the session;
- **Characters:** The list of characters in the game session;
- **Private:** Player character personal traits (constraints, goals, description).

When a player clicks on the "OK" button, the system loads the avatar that will be used to represent the player character. The S-Cube will then display a 3D graphics virtual environment where all avatars can move freely and interact with one another. See figure x-1 and figure x-6.) There is also a two dimensional (2D version of the S-Cube environment that can be used as a staging area similar to classical chat type functionality to focus in on a specific type of soft skill.

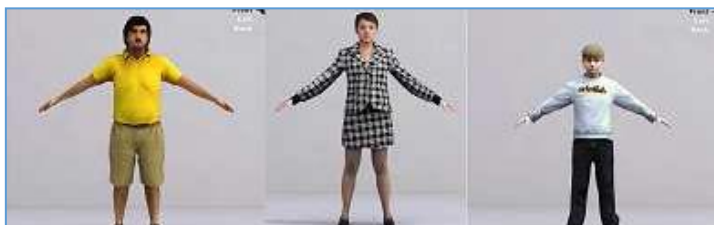


Figure x-6 Physical appearance of S-Cube characters

Role of the trainer in S-Cube

In a role playing game (RPG) session each user is assigned by the trainer a character from the game scenario script/storyboard. Each character, based on the required training, has some character aspects predefined by a soft-skills trainer. The trainer can decide, based on the training needs, to inhibit certain or all kinds of non-verbal behaviour (mood and gestures) depending on the character.

In the "Session Information" window in the "private" tab, a player can display information about their assigned character: allowed non-verbal

behaviour and personal objectives (invisible to other users). The trainer can also decide to change avatar constraints during the session. In this case, a player will be notified with a small message box. Also if a current mood is no longer allowed by the trainer, it is changed automatically and notified to all other players.

The RPG game is played by communicating messages and events in order to move closer to achieving personal objectives. The trainer can intervene and direct messages, send out documents to all players, introduce characters to the 3D world as applicable and also ask players to complete questionnaires. A trainer can also decide to rewind the session to a previous point of the story.

With the S-Cube client software all users (both trainers and players) can review a previously recorded session. These recordings take the form of a 3D interactive video. Players can view the recording from different points of view, shifting the virtual camera to the position they prefer, view the script for the session, insert comments, change the speed of the recording, split the recording into chapters and modify the recording in various ways (for example, cutting out less interesting parts).

The recording of a game is captured in 3D. This makes it quite unlike a normal film. As you watch the recording you can control your viewing position, moving closer or further away from the characters. Through the S-Cube recording feature, trainers can create a commented version of the recording for use during debriefing. This feature provides highly valuable soft-skills related feedback to players post-game. Moreover, where useful, the trainer can provide players with a complete version of the recording, including information which they could not see in the original session. Only trainers have the possibility to record everything that happened in the session, whereas players can only record what they can see.

Player engagement in S-Cube and soft skills features in S-Cube

Lazzaro, a recognised expert in ‘player experience’, explores how to generate maximum enjoyment for players. As part of this, she presents the “4 Keys 2 Fun” (Lazzaro, 2014), in which she describes how her research “went off in search of emotion and found Four Keys to releasing emotions during play”. She identifies these four keys as:

- **Hard Fun:** Emotions from meaningful challenges, strategies, and puzzles.
- **Easy Fun:** Grab attention with ambiguity, incompleteness, and detail.
- **Altered States:** Generate emotion with perception, thought, behaviour, and other people.
- **People Factor:** Create opportunities for player competition, cooperation, performance, and spectacle.

Lazzaro's game experience research "observed many emotions from gameplay in facial gestures, body language and verbal comments" (Lazzaro, 2014). Her paper details a range of emotions that were recognised in gamers other than the expected emotions of excitement, frustration, amusement and sensory pleasure. Emotions such as fear, surprise, disgust, wonder, fiero, naches/kvell and schadenfreude were identified during her research.

The above research outlines a number of key factors to be considered in relation to game experience. Emotion and gestural capabilities are a key factor in addressing the above "4 Keys 2 Fun" and a certain numbers of these keys have been incorporated into the S-Cube design. The S-Cube platform itself does not fall into the typical Hollywood type games researched by Lazzaro's but it does incorporate a number of soft-skills gestural and emotion features that are explained below.

As discussed above, players and the trainer interact via messaging. Each message can be associated with one of seven facial emotional (affective) expressions (see figure x-7) for role playing characters: Neutral; Angry; Distrustful; Doubtful; Sad; Impatient and Happy. Each avatar can also make a certain number of "Gestures" (gestures and actions). This is activated by choosing the desired movement and clicking on the appropriate icon in the "Gestures Panel". (See figure x7).

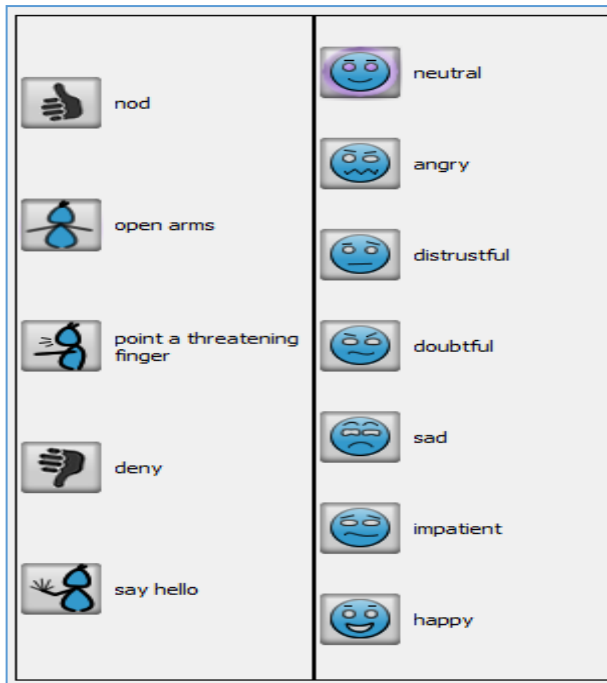


Figure x-7 S-Cube gestures and emotional (affective) expressions

After the gesture has been performed, the avatar returns to its current emotional state (mood). Every player can also send anytime messages to one or all the participants. The player can send the message to: all; one or more selected characters or exclusively to the trainer. Please refer to the S-Cube project web site on <http://www.s-cubeproject.eu/> for access to the full S-Cube user manual (S-Cube partners, 2014).

S-Cube trainer features

This section describes the role of the trainer and how game scenarios are created using the S-Cube editor. It also highlights the criticality of the trainer and how he/she may intervene during a game scenario and also the importance of the trainer-led post-game evaluation process.

Trainer controls editor

S-Cube provides a complete set of tools for trainers. Using these tools, they can organise their teaching in the way they see fit. The tools allow trainers to write the scenario scripts for online multiplayer games. When they design a multiplayer game they can choose the roles, goals and virtual bodies (avatars) of individual players. Once the game is in progress the trainer can watch what is going on from any viewpoint they choose, intervene at any moment, write messages to players or activate special “events”. When the game is over the trainers can become critics by leading a group discussion and analysing the strategies adopted by the players.

In order to create an online training course using the S-Cube platform a trainer follows the process outlined below.

- Using the S-Cube Editor, he/she creates a storyboard with all the information on the scenario (for example, story, goals, characters involved in the story, characters features, events and messages, etc.). Please note that the storyboard must be considered as a sort of “acting plot”. A specific soft-skills training course may consist of several role-playing sessions (at least four). In working through the course, groups of players will complete a number of trainer defined scenarios. Recorded game feedback can be provided as learners progress through the various scenarios presented by the trainer.
- From the S-Cube software website the trainer uploads the storyboard created to the server to make it available to all users. The trainer can also define special features, allocate users for character association in the specific role-playing session and formally start the role-playing session on the server for a defined time-interval.
- Using the S-Cube client the trainer joins the role-playing session as a master along with all the players.

Introduction to the S-Cube game editor

In an online training session, players are less free to interact than they would be in a traditional chat session. The script is written by the trainer.

Players have to take on specific roles and pursue pre-defined objectives described in the script. As they do so they learn about the other “actors” in the story. Trainers can use various tools to make it easier for players to play their parts.

To define scripts and the role of specific actors, trainers use the “S-Cube game editor” that allows them to place constraints on the way players interact, by providing direction to the gameplay. Figure x-8 shows what a trainer sees as they work with the editor to define the title of their scenario (story), general description, selected graphics environment and overall goals (shared objectives).

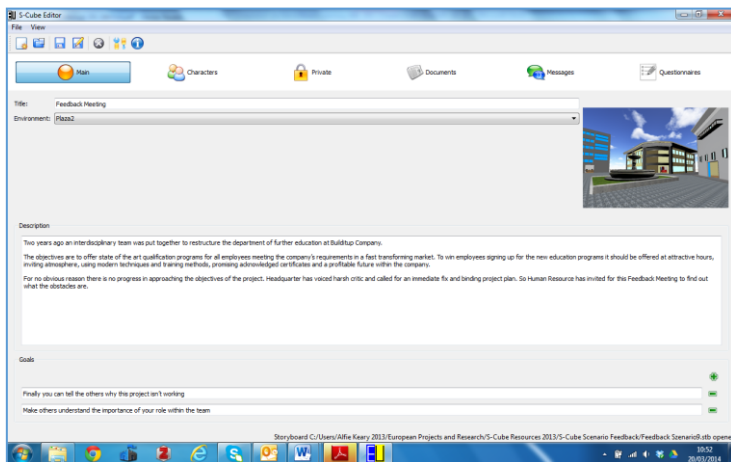


Figure x-8 S-Cube game editor

The game editor software is designed for use by trainers and allows them to manage and plan their training. The editor is divided into six different tabbed areas: 1) Main; 2) Characters; 3) Private information; 4) Documents; 5) Messages; 6) Questionnaires.

Avatar and character creation editor

A trainer can insert information about the characters of the script. A character is selected from a list and the following information is assigned:

- Name;
- Sex;
- Avatar;
- Description: (brief description of the character and his/her personal story);
- Goals: (personal goals for each avatar that enrich the general objectives and that may sometimes conflict with same).

A trainer can also insert non-public information for each character which is only communicated to the player representing the specific character. For each character it is possible to edit: Behaviours(may be used to limit the expressive possibilities of the character giving him/her a personality), Description and Goals as required.

The trainer can also define events (for example, introduce new avatars) and create questionnaires to be used during the game scenario. For each event it is possible to edit the title of the message; the text of the message; the avatar that may deliver a message or document; mood; volume of voice; tone of voice and gestures.

Managing the S-Cube environment

As discussed, before launching a session the trainer needs to upload the associated storyboard to the S-Cube server. Once the storyboard is saved to the server it must then be launched. The launching process involves the association of a number of players with each of the characters in the storyboard. Once the launch process succeeds on the server, players may start the game. As players log in with their allocated user identity they will then take on the allocated persona defined by the trainer.

The trainer joins the game via the 'Master session' log in button on the S-Cube client (see figure x-9). The trainer has the possibility to change the list of available moods/gestures for all the characters, during the game session. This can be actioned directly in the 'Session Info' window by checking or unchecking the corresponding moods or gestures for a specific character.

In summary, trainers can write scripts for online multiplayer games. In designing a multiplayer game they can choose the roles, goals, bodies and personalities of individual players. Once the game is in progress, they can watch what is going on from any viewpoint, intervene at any moment, send messages to players, or activate special events. When the role play is

completed, they can critically analyse, lead a group discussion and evaluate the strategies adopted by the players through a reflective learning mechanism. This reflective step of debriefing is fundamental for the soft skills learning process.

As well as preparing scripts for online games and assigning characters to users, there are two other ways in which trainers (or tutors) can intervene in the learners' interactions with S-Cube. One is to take on the role of one of the characters in the simulation and the other is to act as an invisible stage director. In this second role, soft skills trainers can: a) invisibly observe the interactions among players; b) access the players' 'private characteristics'; c) listen to private messages ('whispers') between players; d) 'broadcast' messages visible to all players; e) exchange private messages with a specific player; and f) activate events, changing the course of the game.

For further details, the S-Cube trainer manual is also available at the same location as the user manual (S-Cube partners, 2014).

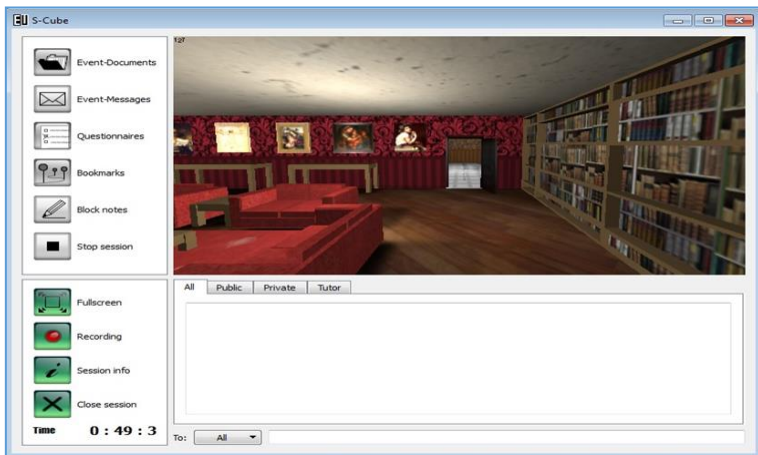


Figure x-9 S-Cube trainer/master interface

S-Cube/EUTOPIA software

This section provides a technical insight into the S-Cube and the underlying EUTOPIA platform technologies.

EUTOPIA technologies

As already discussed the S-Cube games based learning platform is built and powered by EUTOPIA. EUTOPIA is an online 3D role-playing environment similar to other virtual environments like Second Life™ (Linden Research, 2014). With the EUTOPIA platform, educators and trainers can create virtual scenarios where players take on a role and simulate a specific situation. Trainers just need to select one of the predefined 3D scenarios (for example, a city or a meeting room), select the roles to be undertaken (i.e. define the personality and choose a predefined avatar for each character) and assign them to each player. Then the trainer sets up a virtual session (i.e. a simulation) on a server using the created scenario. Players and trainers then join the role play scenario session and interact with each other, following the trainer's pre-defined plan.

EUTOPIA games platform development has incorporated Irrlicht (Irrlicht Engine, 2013) an open source real-time 3D engine written in C++, RakNet (Jenkins Software, 2013), a network API designed for games development and other high-performance network applications and QT (Digia, 2013) C++ class libraries and developer tools.

S-Cube software trials

This section discusses the results of the S-Cube software trials carried out with the UK, Irish and German social enterprise stakeholders.

S-Cube software trials process

Of the 116 volunteers who started the S-Cube Learning Programme (40 in the UK, 53 in Ireland and 23 in Germany), 95 completed both the Self-Reflection Survey of their soft skills and the post-trial evaluation

survey to feedback on suggested improvements to the S-Cube learning programme in Trial Cycle 1. Seventy-seven participants (38 in the UK, 26 in Ireland and 13 in Germany) successfully finished the training, with 61 completing the two surveys at the end of Trial Cycle two. Overall, the results show a much improved perception of S-Cube between Trials one and two.

In relation to the ‘Gaming Experience’, the comparison of means indicated an improved overall perception of S-Cube between the two trials. Trial two participants were more inclined to agree that they became immersed in the role play and remained focused throughout. As might be expected, the experience was less challenging and fraught for participants the second time around. In all aspects of learning measured there was a clear improvement between the two trials. This factor also most likely reflected the improvements made to the learning materials ahead of Trial two. Also, having mastered the technical aspects of the activity during Trial one, it is likely that participants were more focused on the learning/soft-skills aspects of S-Cube during Trial two.

Significant effort was directed at enhancing aspects of the software ‘Usability’ based on feedback from Trial one. This was reflected in very positive improvements in mean scores across all survey items relating to usability after Trial two. The enhancements made to both the S-Cube software and the related scenario and learning materials resulted in a higher level of engagement and interest at Trial two. Participants were also a lot more likely to recognise the value of the learning approach used via S-Cube.

Results and feedback

Following on from Trial one, in relation to the strengths of the S-Cube learning programme, all respondents judged that the programme could provide an opportunity to put yourself into a different mind-set and an effective way to teach soft skills, and in particular communication skills, through a distance learning environment. Participants also highlighted a number of software limitations, inter alia: the inability of their character to speak to different combinations of characters; difficulty in following character conversations because there were too many visible windows with messages/information on the screen; problems with the movement of the avatars; and the limited range of gestures and moods open to the

avatars. On the topic of software improvements, the respondents confirmed the above limitations and provided some recommendations on overcoming these with the software environment. These suggestions provided a foundation for the enhancements to the S-Cube learning programme ahead of the second cycle of trials.

The following comments represent the views of participants who experienced two cycles of workshop trials and therefore spent some considerable time engaging with the software, the scenario and the associated learning materials. Regarding the strengths of S-Cube, many participants reported that it was easy to use and that it was a fun, engaging experience. Such engagement from a mixed group of users with different levels of experience with computer technology is a very positive outcome for the project. Other participants commented on the adaptability of the learning platform across different learning contexts and some suggestions were made in this regard as to extending its application to new environments. With respect to the limitations of the S-Cube learning programme, most responses focused on technical aspects of the game (e.g. the text/dialogue functions) or the need to ‘multi-task’ in order to effectively use the various avatar movement and communication functions simultaneously. There was little feedback on the scenario under trial, though some respondents felt that the goals of the activity could have been clearer.

Going forward, a challenge will be to make the interface and functions more intuitive within the constraints of available technology. Suggestions for improvement reflect the limitations identified above and include comments on how advanced technologies such as facial recognition software might be integrated into its functionality. It is clear that as more technologies emerge, there is great potential to enhance aspects of the S-Cube software further to improve its fidelity and make it more intuitive for players. Additional comments offered by participants confirm that the software and support resources were noticeably improved between the two trialling cycles.

General observations

Overall, a comparison of responses between Trial one and Trial two indicates that there was a modest but generally positive impact on participants’ self-perceived soft skills as a result of the training intervention. Also, participant perceptions of the S-Cube learning

programme became more favourable after Trial two, reflecting the positive impact of improvements and changes made to the software, scenarios and learning materials by project partners. The reasons for participation across the partners was varied but most volunteers either wanted to develop their soft skills or find out about how to use the S-Cube to develop the soft skills of others. The overall feedback from the software trials on the software capability was generally positive, but there were a number of key recommendations on how to engineer a more intuitive S-Cube environment. With an eye to the future the next section discusses a number of key innovations from an S-Cube and GBL perspective.

S-Cube future research and development

The above results point to a reasonable user acceptance of GBL for the development of soft skills in a social enterprise context. That said, there is feedback and evidence of the real-life limitations in using such technologies to enhance and develop soft skills. In our quest for greater acceptance of the S-Cube platform, Piwek, et al., (2014) discuss the *uncanny valley hypothesis* in relation to the acceptance of artificial characters by humans. The authors explain that the “*uncanny valley hypothesis*” (Mori, 2012) states that the acceptability of an artificial character will not increase linearly in relation to its likeness to human form. Instead, after an initial rise in acceptability there will be a pronounced decrease when the character is similar, but not identical to human form” . It is generally believed that movement would actually accentuate the dip in the uncanny valley. Mori and more recent research by Piwek all relate to how more human-like characters are accepted in a typical game-based learning platform. Piwek et al. (2014) claim that their research found that “improving the motion quality systematically improved the acceptability of the characters” and thus improved user acceptability. This research disputes the original claims by Mori on the uncanny valley and points towards greater user acceptance of avatars that incorporate more realistic movement. We now take up on the above notion of ***increased user acceptance of avatars*** as we argue for the development of emotionally and perceptually aware GBL platforms such as S-Cube.

Making GBL systems more emotionally and perceptually aware

Rosalind Picard is one of the most influential and noted researcher in the field of affective computing and is credited with defining the field as ‘computing that relates to, arises from, and deliberately influences emotion’ (Picard, 1997). Picard sees the role of affective computing research involving the analysis of how emotion works, how to build it, how to measure it, how to help people better communicate and understand it, how to use this knowledge to engineer smarter technology, and how to use it to create experiences that improve lives (Picard, 2010). In Picard’s original 1997 work, *Affective Computing* (Picard, 1997) she outlines the emotion indicators that are apparent or indeed less apparent to others. Emotions that are easily apparent to others are facial expression, voice intonation, gesture movement, posture, and pupillary dilation. Emotions not easily apparent to others include respiration, heart rate, pulse, temperature, electrodermal response, perspiration, muscle action potentials and blood pressure (Picard, 1997).

Perceptive (perceptual) computing provides for the development of next generation of immersive and engaging software applications that incorporate close-range depth tracking, speech recognition, facial analysis and augmented reality on tablet, TV and PC devices (Intel, 2014). It is hypothesised that both affective and perceptive technologies could vastly enrich the quality of computer mediated communication in GBL by sensing the emotional state of participants and reflecting that state to other players via an on screen avatar/representation.

Indeed the concept of affective computing in games generally is one that is gaining traction. Hudlicka (Hudlicka, 2008) proposed new approaches to affective computing in games design. Rather than hard coding of affect features into a game she proposes user models. Her paper explains that user models are representational structures that store details on the affective makeup and characteristics of a player. The model identifies the stimuli that trigger specific emotions and the resulting behaviours associated with different emotions. Hudlicka’s work emphasises the concepts of adapting to the player’s emotions to minimise frustration and challenge the player at greater personalised game levels. This also relates to a number of the emotional aspects previously discussed by Lazzaro.

Automatic recognition of boredom in video games is the subject of research conducted by Giakoumis et al. (Giakoumis, et al., 2011). Their research uses biosignals to identify periods of induced boredom during

play on a specially developed video game. This research used Legendre and Krawtchouk moments for affect recognition. Using moment variations it was found to reach 94.17% accuracy in predicting boredom in players during game play. The authors suggest that while their work primarily studied the binary classification of boredom there is “strong indication that moments and moment variations can be used in the future as helpful biosignal features towards the more accurate recognition of affective states” (Giakoumis, et al., 2011).

While there is considerable academic activity in affective and perceptive computing there is also increasing commercial acceptance of the technologies. Affdex from Affectiva (Affectiva, 2013) is a cloud-based platform used to read facial expressions to measure identifiable emotional connections with advertising, brands and media. According to Affectiva, Affdex uses patented emotion algorithms, machine learning and computer vision technologies. The service takes a video feed and analyses each frame to identify recognised affective states and incorporates head gestures, eye tracking and physiological signals as inputs to the Affectiva emotional algorithms.

In relation to the S-Cube platform, if it and similar GBL systems are to evolve as an all-encompassing world then there is clear evidence relating to the need for more emotional and perceptual embodiment in games-based learning. The next section presents some of this evidence from those that participated in the S-Cube trials.

S-Cube current gesture and emotional features feedback

The S-Cube software research surveys collected qualitative feedback from trial participants. The following extracts relate to direct player feedback on emotional and perceptual features.

“It was difficult to see them (avatars) and gauge what they were feeling.”

“More focus on facial expression in graphics (avatars).”

“Innovative, could have done with a few more moods: indifference, happy and signal/gesture for goodbye.”

“I also found using the gestures features very annoying. The task of trying to type your dialog and introduce a gesture was very difficult, which stopped the flow of communication.”

“Consider a right/left hand version; it may improve use of gestures.”

“Limited gestures and interactions.”

“More mood choices and gestures.”

“Better feelings, facial expressions unclear.”

“There should be text showing emotion also.”

The overall research indicates that computer mediated role-play games have potential for soft skills’ learning and training. That said there is considerable research and development required in relation to engagement, immersion, focus and real-world potential. From the evidence presented above it is clear that players can easily interact within the S-Cube environment but moving to a higher level of soft skills’ emotional engagement is currently extremely limited. In particular the linking of user’s emotions and actions to on screen avatars is difficult through mouse and keyboard. The limitations of gestural inputs can now be addressed with the more recent developments in perceptual computing. As new research and technologies emerge from affective computing and other fields, it may be possible to engineer platforms such as S-Cube with ever more realistic features that get one step closer to real-time face to face interactions.

The remaining section below, presents our research and insights into a proposed affective and perceptive aware next generation of the S-Cube platform known as **ACTOR**.

Affective and perceptive aware S-Cube - ACTOR

The current user interface to S-Cube is primarily via mouse and keyboard. From an affective and perceptive capability, changing your body language, communicating your feelings and verbally interacting all at the same time is not technically possible in the current iteration of S-Cube. While there are many technical options to enhance the S-Cube (such as speech to text, machine translation, text analytics, video integration), our

primary interest is in the development of more realistic capabilities that can directly track a user's emotional and perceptual state and reflect it in the related S-Cube avatar and 3D world.

Development tools such as the Intel Real Sense SDK (Intel, 2014), OpenCV SDK (OpenCV, 2013) and OpenNI SDK (OpenNI, 2013) offer a range of interfaces and vision algorithms for the processing of 3D depth images and facial analysis. Such technologies may be used to integrate real-time gestures and user emotions directly with the associated avatar. In addition to video analysis of gestural and facial expressions the integration of biosignalling devices offers a greater level of real emotional data capture. Non apparent bodily cues offer deeper insights into a user's emotional state at any one time. According to Reuters (2014), "voice-controlled smart watches that track heart rates and connect to phones and tablets will debut in 2014". This March 2014 announcement is related to Google Wear. The press release went on to state that Google Inc. will partner with "electronics, technology and fashion companies to take consumers to the next promised frontier in computing" (Oreskovic, 2014). Such wearables may well see future biosignal emotion data capture technology being embedded in devices that will become smaller, smarter and a lot less invasive (see figure x-10 references 1 and 2).

At a deeper level, it was considered how an affective software analytics engine (capable of conveying emotional state information to players in the GBL environment) would need to be developed. Indeed, such affective analytics systems are currently under development at the Swiss National Center of Competence in Research "Affective Sciences" (Swiss NCCR Affective Sciences, 2012). The NCCR are researching and developing a tool called EATMI (Emotional Awareness Tool for Mediated Interaction) for the automatic prediction of emotional states from behavioural and physiological cues (see figure x-10 "Affective Computing Analytics Engine" reference 3).

A user's private emotional state is extremely sensitive information and needs to be handled accordingly. Emotion state analysis may be communicated directly to the user whilst participating in a GBL environment. Part or all of this data may also be communicated to other parties/players. A player alert service could offer control and security of emotional state information that would ultimately be managed and communicated based on a user profile/model (Hudlicka, 2008). From an S-Cube perspective the identification of a user's emotional state may also be viewable by a soft skills trainer. Such a service could lead to more direct

trainer interventions and engagements with a player (see figure x-10 “Affective Alerts & Affective Vault” reference 4).

An introspective software service that will provide after game analysis and interpretation of emotional charged activities that resulted from participating in GBL is also proposed. Players will be able to evaluate how they reacted to various scenarios and situations that occurred during play. This service may also be used to deliver real-time soft skills advice and direction to a player on how to deal with a specific emotional charged situation. Such interventions may be the connection of an expert with the user to provide real-time assistance (soft skills trainer) or it may deliver some automatic general advice on dealing with highly emotional situations. System generated advice and guidance could become more user targeted as the system learns, reacts and refines the emotional model/characteristics of the users it interacts with on a regular basis (see figure x-10 “Affective Guidance Services” reference 5).

Figure x-10 provides a graphical representation of the architecture and interconnectivity of a software engineering proposal known as S-Cube - *Affective Computing Through SensOry Recognition* (ACTOR). We believe that the software engineering of the below S-Cube **ACTOR** components could bring about true affective and perceptive capabilities to the next generation of S-Cube and related GBL platforms.

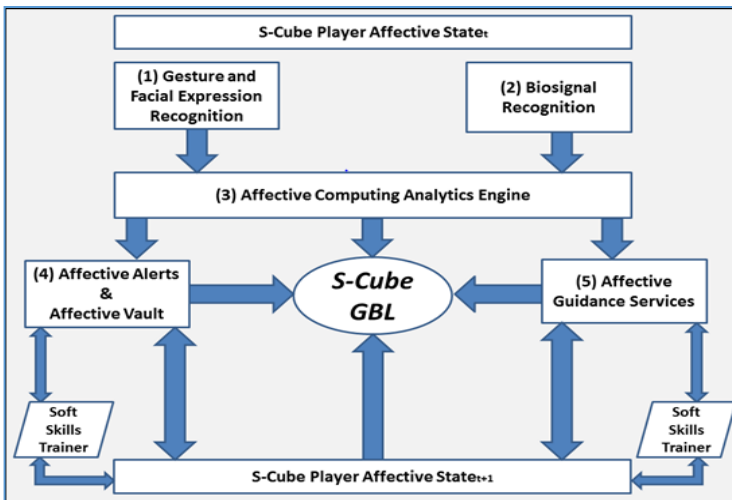


Figure x-10 S-Cube - ACTOR

Conclusions and further details

This chapter has evidenced the recent developments of the S-Cube software environment and demonstrated the levels of impact that the S-Cube learning programme has leveraged over soft skill development in members of the social enterprise community, and its future potential as an adaptable and sustainable learning platform.

The S-Cube project, with financial support from the EU Leonardo Transfer of Innovation fund has delivered a learning programme that is informed by both psychological theory and business practice and has been validated as a coherent and well integrated approach to soft skills development for social entrepreneurs. The modular programme is relevant and engaging and underpinned by an innovative way of using online, avatar based role play to help develop some of the key competencies and skills required to work successfully in the social enterprise workplace.

In addition, we have presented a practical overview of the S-Cube platform from both a player's and trainer's perspective. It is hoped that the various references provided will encourage our readers to explore the software results of the S-Cube project further and to start to experiment with the platform for their soft skills training needs.

Traditionally soft skill training and education is delivered face to face and it is accepted that a 3D virtual environment such as S-Cube has several limitations. That said, we have concluded our chapter with a technical discussion on how GBL platforms can incorporate innovations such as perceptual and affective computing technologies. In the not too distant future it may well be possible to deliver services that may ultimately enhance, match or perhaps even supersede face to face communications engagement.

Finally in relation to enterprise accessibility the fact that S-Cube can be played anywhere across the Internet means that social enterprise employees can continually enhance their communication skills using scenarios relating to the needs of their organisation. The S-Cube platform is fully available to SEs and other organisations that wish to incorporate the platform into their communications/soft skills training programmes. Full multi-lingual training manuals (currently English, Italian and German) are also available on the S-Cube project site along with free access to the software client and games editor.

If you are interested in further details in relation to S-Cube training, technical deployment or consulting services then please make contact via the S-Cube website on <http://www.s-cubeproject.eu/>.

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