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The Serious Game Modeling Language ATTAC-L Applied to Reach Out Central (ROC): Findings and Recommendations

Graduation thesis submitted in partial fulfillment of the requirements for the degree of „Master of Science in Applied Science and Engineering: Computer Science“

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Abstract

ATTAC-L is a domain specific modeling language developed to facilitate non-technical people (people without a programming background) to express the narrative content ("story") of educational games as formal descriptions in the context of cyber bulling prevention domain. In addition, the ATTAC-L language is extended to model the pedagogical aspects of serious games. However, the current modeling concepts provided to the modeler for modeling the educational aspects are very general; they do not belong to specific learning theory.

The aim of this thesis is to verify the generality of the ATTAC-L language and when needed to propose extensions or adaptations. For this purpose, we investigate an existing educational video game named Reach Out Central (ROC) in this dissertation. ROC is mainly standing on the principles of cognitive behavior theory (CBT) to enhance mental health of youngsters (J. Burns, Webb, Durkin A, & Hickie, 2010).

The story part of ROC is modeled by means of ATTAC-L to indicate how this language has the capability to describe the narrative of a serious game belonging to other domain not only cyber bulling.

Moreover, the pedagogical aspects of ROC are modeled on top of the story in more generic way with respect to CBT. Social Cognitive Theory (SCT) is also considered in this thesis because it is an important behavior change theory in health educational video games.

Keywords: ATTAC-L, ROC, Cognitive Behavior Therapy, Cognitive Restructuring, Negative Thought, Social Cognitive Theory, Modeling, Self-Efficacy, and Feedback.

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Glossary

DSML: Domain Specific Modeling Language

Friendly ATTAC-L: a Domain Specific Modeling Language

DSVL: Domain Specific Visual Language

WEEV: Writing Environment for Educational Video Games

GM-LM: Game Mechanics and Learning Mechanics Model

ROC: Reach Out Central video game

SQ: Squre Quest video game

NPC: Non-Playable Character

SLT: Social Learning Theory

SCT: Social Cognitive Theory

CBT: Cognitive Behavior Theory (Therapy)

NAT: Negative Atomic Thought

CD: Cognitive Distortion

TPS: Third Person Shooter

Chapter 1

Introduction

This first chapter we present the context of the thesis, the problem to solve, and the research approach used to resolve the problem, and the structure of the entire thesis.

1.1 Context

This thesis is performed in the context of the " Friendly ATTAC-L" project, which aims to develop video games in the cyber-bulling domain in order to assist youngsters coping with cyber bulling problems (Van Broeckhoven, 2013). The thesis is mainly situated in the domain of health-oriented educational video games and is focusing on the ATTAC-L language developed in Friendly ATTAC to specify scenarios for health educational video games. We briefly discuss the domain and ATTAC-L in the following subsections.

Health-Oriented Educational Games

Video gaming is an important activity for millions of people especially young generations from all over the world access them through various digital devices, e.g., PCs, mobile phones, and tablets in an online or offline form. The learning aspect of digital games is considered nowadays highly valuable since these games contain numerous characteristics such as interactivity, personalization, and state of art computer technologies, which could make them a very promising tool for education. In general, the term "serious games" (SGs) is used for digital games with a purpose other than entertainment, such as education, simulation, research, and health and therapy purposes (Thompson, 2012).

Educational games are a kind of serious games that are particularly developed with the aim of more than entertainment to provide learning opportunities for people in order to improve their skills and knowledge in a meaningful way (Thompson, 2012). They can also be used to train or change attitudes and behavior. Also in the domain of health care, serious games can be used for these purposes (Thompson, 2012).

To develop a successful serious game, people with different backgrounds are required to be involved such as pedagogical experts, therapist, and developers. For example, a narrative-based digital game to prevent obesity among children requires making collaboration between game designers and behavioral scientists to combine their skills and talents to create a highly focused serious video game that entertains while promoting behavior change (Thompson, 2010). This comprehensive collaboration demands tools usable by non-technical people (i.e. behavioral scientists), for instance for designing the narrative part of the game and inserting the pedagogical aspects without the need for programming.

ATTAC-L

This thesis is performed in the context of the "Friendly ATTAC-L" project (Van Broeckhoven, 2013). Friendly ATTAC project has the aim to develop a video game to prevent cyber bulling behavior. The type of digital game considered in this project is action adventure or role-playing genre backed by a story.

People with different backgrounds such as domain experts need to be involved in the development process of the game to develop an effective educational video game in the domain of cyber bulling. Hence, the ATTAC-L language has been developed in this project to allow non-technical people such as domain experts to participate in the game development. ATTAC-L is a domain specific modeling language (DSML), designed to facilitate non-technical people to describe in a formal way (model) the narrative content ("story") of digital (educational) games or so-called (educational) virtual scenarios (Van Broeckhoven & De Troyer, 2014). A DSML is a (visual) high-level modeling language to model an application for a very specific domain. It must support a high level of

abstraction by using a dedicated syntax and graphical notations. As a result, it makes easier for non-technical people to understand the large amount of information (J. Marchiori, del Blanco, Torrente, Martinez-Ortiz, & Fernández-Manjón, 2011). Apart from this narrative content modeling, ATTAC-L also allows to model educational concepts on top of the narrative model. For this purpose, a system of annotating the storyline model has been introduced. In this way, the educational or pedagogical aspects are identified on top of the storyline model. This allows the modeler to concentrate on the story flow or on the pedagogical aspects of the game separately (Van Broeckhoven & De Troyer, 2014).

1.2 Problem Description

ATTAC-L has been developed in the context of cyber bulling prevention to model the narrative part of a serious game. In principle, it should be feasible to replace the cyber-bulling domain by another domain. In the context of this thesis, we shall verify whether it is indeed possible to model another educational video game by using ATTAC-L. The aim is to verify the generality of the ATTAC-L language and when needed to propose extensions or adaptations.

Moreover, the current modeling concepts provided to the modeler for modeling the educational aspects are very general; they do not belong to specific learning theory. A better embedding of these education-oriented modeling concepts into specific learning theories could be beneficial and could provide more support to the modeler. Thereby, we expect that we will need to refine and elaborate the modeling concepts for expressing pedagogical aspects. This requires a further investigation of how principles used in education can be mapped onto educational games.

1.3 Research Approach

To investigate the generality of ATTAC-L, we will use the language for modeling an existing education video game. While doing this, we may come across features or aspects

that cannot be modeled with ATTAC-L, in that case extensions to the language may be needed. If we can model the game with ATTAC-L then this is an indication that the language is general enough to be used in different domains, although it is not a proof.

To investigate the second purpose of the thesis, a better embedding of the education-oriented modeling concepts into existing pedagogical theories, we will use the same game as case study. Therefore, we need to find an appropriate existing educational video game.

The target game must conform to several conditions. First of all, the game must be backed by a story since ATTAC-L is a tool designed to model the narrative or story of educational video games. Secondly, the game must follow a specific learning or behavior change theory because we want to be able to model these educational or pedagogical aspects of the game as well. In ATTAC-L, specifying the pedagogical aspects is done on the top of the story by means of a system of so-called annotations. This way, we will be able to investigate if new annotation concepts are needed to support a certain learning paradigm.

Last but no least, the game must be available to play to be able to explore the game and understand its principles. We can split this process up in a number of steps, described in the following subsections.

1.3.1 Finding a Suitable Educational Video Game

A couple of educational video games were considered to be modeled by means of the ATTAC-L language including FearNot![1], SimCity[2], Betwixt Folly and Fate, Argument wars[3], Half the Sky Movement[4], and other educational video games, but neither of them were fulfilling the requirements. After some research, we discovered a database

[1] http://sourceforge.net/projects/fearnot/

[2] http://www.simcity.com

[3] https://www.icivics.org/games/argument-wars

[4] https://www.facebook.com/HalftheGame

containing hundreds of games and publications that all focus on the use of digital games for health and health care[5]. Then we opted to concentrate on this domain. We could find several publications about various kinds of educational games in the diet and physical activity area, like Squire‟s Quest! (SQ!) (Baranowski, Baranowski, Marsh, & Islam, 2003), Boy Scout 5ADay Badge (Thompson, Baranowski, Baranowski, Cullen, & Jago, 2009), Escape from Diab (Thompson, 2010), EA Sports Active 2 (Jane Lyons & Hatkevich, 2013) , and Nanoswarm: Escape from Inner Space. All these games are backed by a story, and are based on specific behavior change theories (i.e., Social Cognitive Theory, Elaboration Likelihood Model). However, none of these games are available to play at the moment, since they are still under clinical test. Finally, we found Reach Out Central (ROC) video game[6] that is in the category of mental health oriented serious games. It was available in online and free of charge. It is stated that the pedagogical structure of the ROC game is standing on the principles of cognitive behavior theory (CBT) to improve the youngsters with mental health problems. Social Cognitive Theory (SCT) is also mentioned as a model of learning for behavior change but not very explicitly (J. Burns et al., 2010).

1.3.2 Analyzing ROC Game

As we discussed, the Reach Out Central (ROC) video game was opted as it could fulfill our requirements. It is stated that the pedagogical theory of ROC game is depending on the principles of cognitive behavior theory (CBT) to enhance youngsters with the mental health problems. Social Cognitive Theory (SCT) is also mentioned as a complete model of learning for behavior change but not explicitly. However, there are no publications for this game to illustrate how these theories are used in the game to achieve the goal of the serious game. Therefore, in the scope of this thesis, we will first analyze ROC to find out the behavior change or pedagogical elements associated with SCT and CBT in this game.

[5] http://www.healthgamesresearch.org/db

[6] http://www.healthgamesresearch.org/games/reach-out-central

1.3.3 Modeling ROC Game through the ATTAC-L

In this step, we will first show the main principles of the ATTAC-L language that are used to express the story of ROC. Then, we will revise ATTAC-L and formulate the new language concepts needed to model the pedagogical aspects of ROC.

1.4 Thesis Structure

In this first chapter we explained the context of the thesis, the purpose of the thesis, the research approach followed, and we provide the structure of the thesis.

In the second chapter we will provide background information related to this. We will discuss two important behavior change theories used in ROC: cognitive behavior therapy (CBT) and social cognitive theory (SCT). Afterward, two examples of health behavior change video games will be discussed. Firstly, Re-Mission video game along with its game mechanics and learning mechanics model (GM-LM) will be described. Accordingly, we will investigate on the Re-Mission 2 video game to get a better idea on how game mechanics and learning mechanics can be mapped into serious games. Secondly, we will study the Escape from Diab game to comprehend how SCT is used in this game to influence player‟s learning and behavior change.

In the third chapter we analyze the selected game called ROC (Reach Out Central)[7], in order to investigate the pedagogical components of this game with respect to CBT and SCT.

In the fourth chapter, we will first illustrate the main principles of ATTAC-L in order to indicate how ATTAC-L has capability to model the narrative part of ROC. Next, we will concentrate to model some educational aspects of the game related to CBT and SCT.

In chapter five, we present two related work of ATTAC-L.

The sixth chapter is the final chapter of this thesis. It summarizes the work done in the section above and conclusions drawn.

7http://www.reachoutcentral.com.au

Chapter 2

Background

In this chapter we discuss the terminologies and definitions that are essential to understand the future chapters of this thesis. Firstly, the introduction of ATTAC-L is presented. Next, SCT and CBT are discussed elaborately as the pedagogical framework of the ROC game is standing on the principles of Cognitive Behavior Theory (CBT). Social Cognitive Theory (SCT) is also mentioned as a model of learning for behavior change in this game but not explicitly (J. Burns et al., 2010).

Afterward, the Re-Mission and Escape from Diab games are explained. The Re-Mission video game is discussed to learn how gaming mechanics can be used for the pedagogical purposes. Accordingly, we investigate the Re-Mission 2 video game to get a better idea on how game mechanics and learning mechanics can be mapped onto serious games. Subsequently, we study the Escape from Diab video game to comprehend how behavior change components based on SCT can influence the player‟s learning and invoke behavior change.

2.1 ATTAC-L

As already mentioned, ATTAC-L is developed in the context of the “ Friendly ATTAC” project (Van Broeckhoven, 2013). Friendly ATTAC project aims to develop a story-based video game on the domain of cyber bulling. To develop an effective educational

video game, people with different fields such as domain experts (i.e., psychologists) need to be involved in the development process of the game. Hence, the ATTAC-L language has been developed to allow non-technical (non-programmer) people to be involved in the game development process. ATTAC-L is a domain specific modeling language (DSML), designed to facilitate non-technical people to describe in a formal way (model) the narrative content ("story") of digital (educational) games or so-called (educational) virtual scenarios (Van Broeckhoven & De Troyer, 2014). A DSML is a visual language to model an application for a very specific domain. It must support a higher-level abstraction by taking advantage of graphical notations and a dedicated syntax. As a result, it requires less effort to understand the large amount of information by the non-technical users (J. Marchiori et al., 2011) (Van Broeckhoven, 2013). Apart from this narrative content modeling, ATTAC-L also permits to model pedagogical concepts on top of the narrative model. For this, it makes an explicit bound between the narrative content and learning aspects of the modeled virtual scenario. This allows the modeler to concentrate on the story flow and pedagogical aspects separately (Van Broeckhoven & De Troyer, 2014). The elaborate explanation of ATTAC-L will be presented in Chapter 4.

2.2 Pedagogical Theories

It is stated that the pedagogical framework of ROC is based on the principles of cognitive behavior theory (CBT) to enhance the mental health of young people. Social Cognitive Theory (SCT) is also mentioned as a comprehensive model of learning for behavior change in this game but not obviously (J. Burns et al., 2010). An elaborated description of SCT and CBT is described in the following parts.

2.2.1 Social Cognitive Theory (SCT)

Social Cognitive Theory (SCT) refers to a psychological model of behavior that developed primarily by Albert Bandura. Initially, SCT was known as social learning theory (SLT). SLT emphasizes that learning occurs in a social environment and

individuals learn through watching model‟s behavior and consequences of those behaviors (Bandura, 1977). SCT evolved from SLT with more emphasis on the cognitive processes that affects learning (Bandura, 1986). Cognition is the mental process by which knowledge is gained such as thinking, perception, memory, problem solving. SCT describes that people learn by watching others, with the environment, behavior, and **personal factors** (cognition; the internal working of individual). They are all the essential factors in influencing one another (see Figure 2.1) (Bandura, 1986).

SCT has been applied to diverse domains including psychology, education, organizational behavior, and physical health (Lent, Brown, & Hackett, 1994)(Pajares, 2001).

Environment mentions to the components that can have the influence on a one‟s behavior and contains situation, roles, models and relationships, which is the social part of the theory (Parraga, 1990) (K Glanz, Rimer, & Lewis, 2002). Personal factors or psychological determinants have been identified in SCT as cognitive (the internal working of individual) aspects of this theory such as the goals that individual has, self-efficacy (confidence in ability to perform a behavior), self-regulation, (see section 2.2.1.6), outcome expectancies (anticipated consequences of behavior change), and behavioral capabilities (level of knowledge to perform a behavior). (McAlister, Perry, & Parcel, 2008). SCT continued to develop emphasizing the process of goal setting, self-efficacy, and self-regulation (Bandura, 1986).

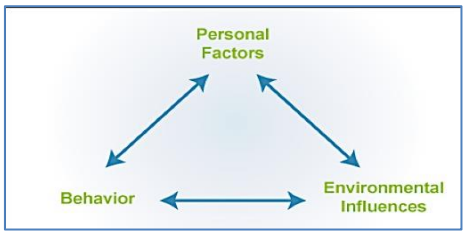

Figure. 2.1: Social Cognitive Theory Model (Bandura, 1986)

SCT proposes that behavior modification is a basis of enhancing skills and confidence (self-efficacy) in performing new behavior, while modeling and feedback are foundations for learning skills (J. Burns et al., 2010)(Baranowski, Budy, Thompson, & Baranowski, 2008).

Several core concepts exist in SCT including self-efficacy and outcome expectations as psychological determinants, observational learning (modeling), behavioral capability (knowledge), reinforcement, and self-regulation (McAlister et al., 2008) (Thompson, Baranowski, Buday, & Baranowski, 2007) (Bandura,1986). They will be covered in the following sections.

2.2.1.1 Observational Learning (Modeling, Vicarious Learning)

Modeling (or observational learning) is the process of learning by observing others to produce a behavior before doing it oneself (Lewis Hobart, 2012). This can be considered as a therapeutic technique to produce behavioral change. People may indirectly experience the entire scale of challenges and expectations of a certain behavior and while attaining knowledge and skills required to perform a behavior. Models (ones who demonstrate the behavior to the learners) can be categorized in various types. For instance, coping models are models demonstrating the problems and the normal behavioral deficiencies and probably fears of observers, but enhancing the behavior and self-efficacy eventually. These models exhibit how positive thought can solve the problem whereas mastery models are expert or proficient models when presenting a skill. Cognitive modeling occurs when a model verbalizes her thoughts while demonstrating a cognitive process or skill (Schunk, 1995).

Modeling can affect behavior in two ways: Facilitation or Inhibition (Pajares, 2001). Facilitation is seeing a model that is reinforced positively (vicarious positive reinforcement) for a behavior, so the learner may repeat the behavior. For instance, when a child in kindergarten sees some other child sitting well during story time and is

encouraged by the coach, it is also inclined to sit well. Inhibition is when the observer sees a model being punished and therefore the learner may not repeat the behavior.

Video games have the capacity (through symbolic models) to support observational learning. They allow players to have both observational as well as experiential learning (Lewis Hobart, 2012). In EA Sports Active 2 video game, for instance, the player can select female or male personal trainer model that performs the exercises to show proper form (see Figure 2.2) (Jane Lyons & Hatkevich, 2013).

Figure 2.2: Mastery model in EA Sports Active 2 video Game

2.2.1.2 Behavioral Capability (Knowledge)

Behavioral capability signifies that if one is to carry out a behavior he must have the knowledge what the behavior is in order to perform it (McAlister et al., 2008) (K Glanz et al., 2002). In other words, behavioral capability is the knowledge and skill that are important to perform a behavior. It promotes mastery learning through skill training (K Glanz et al., 2002).

2.2.1.3 Reinforcement (Feedback)

Reinforcement refers to the responses to a person‟s behavior that raise the possibility of maintaining the behavior (McLeod, 2007). Reinforcement (either positive or negative) can be in form of internal (i.e. pride, satisfaction, sense of accomplishment) and external

(environmental reinforcement). For instance, a child might be giving praise immediately after she puts away her toys (the response). Therefore, the desired behavior (putting away the toys) is reinforced positively (by giving praise). Hence, the child will be more likely to repeat the desired behavior again. On the contrary, the desired behavior can also be reinforced negatively. For instance, if a student does not complete his homework on time, he might get negative feedback from the teacher. In both cases, the desired behavior is strengthened either positively or negatively. Positive reinforcement (i.e. reward) can be used to boost self-efficacy by presenting a motivating or encouraging feedback to the person after the desired behavior is exhibited (for instance, a coach says to a student "Great job!" after accomplishing his homework successfully) (McLeod, 2007). Reinforcement can be categorized into two types: (1) Direct reinforcement, which means that reinforcement is experienced directly by the learner; (2) vicarious reinforcement (the consequences of the behavior of the model are observed by the learner) (Pajares, 2001) (Bandura, 1986).

2.2.1.4 Boosting Self-Efficacy

Self-efficacy is a one‟s confidence in his or her ability to perform a behavior. It is considered as the most powerful element of social cognitive behavior. If self-efficacy is lacking, people tend to behave inefficiently, even though they know what to do (Bandura, 1986). SCT specifies four major ways to enhance Self-efficacy: (1) mastery experience, (2) models, (3) improving physical and emotional states, and (4) verbal persuasion.

Mastery experience is performing a task successfully that strengthens person‟s self-efficacy dramatically (Bandura, 1986)(Bandura, 1997). Mastery experience can be achieved when people participate in activities, they interpret the result of their behaviors, and use their interpretations to develop beliefs about their capability to engage in subsequent activities (Pajares, 2001).

Models can have an influence on self-efficacy profoundly. If learner knows what to do to perform a behavior or task by watching a competent model that performs actions successfully. Subsequently, the player‟s self-efficacy will be raised to perform the same

action (Schunk, 1995). Perceived similarity to models (models who have more similarities to the observer) can also increase one‟s (observer) self-efficacy (“**If they can do it, so can I**”) (Schunk, 1995). Modeling can help the learners to clarify their expectations for performing a certain behavior as they can have idea what the consequence of their behavior will be if they have observed a model (Lewis Hobart, 2012).

Verbal/written persuasions are positive statements to increase self-efficacy (i.e., “You can do this”) (K Glanz et al., 2002)(Jane Lyons & Hatkevich, 2013). Evaluative feedback (indicating that individuals are performing well or making progress) can raise the learner‟s self-efficacy (Schunk, 1987), (Jane Lyons & Hatkevich, 2013)(Schunk, 1995).

Physiological and emotional states such as anxiety, stress, fear, and excitement change self-efficacy since individuals rely on their emotions and feelings when judging their capabilities. So positive mood enhances self-efficacy, while negative emotion diminishes it (Bandura, 1997)(Pajares, 2001). For instance, concentrating on negative thoughts can reduce self-efficacy and consequently result in additional stress and inadequate performance. Thus, one way to raise self-efficacy beliefs is to improve emotional well-being and reduce negative emotional states.

Goal setting and demonstrating positive outcomes of performing a desired behavior (positive outcome expectancy) can raise self-efficacy (Schwarzer & Fuchs, 1995). Goals can give people "tunnel vision" to concentrate on a certain goal (task) and select the suitable technique to accomplish a task. This is likely to enhance performance and self-efficacy(Schunk, 1987).

2.2.1.5 Outcome Expectancy

Outcome expectancies refer to the assessments of the outcomes associated with a behavior. People create outcome expectations about the very probable outcome of future behavior, which is based on how current responses are reinforced or punished. In other words, it is defined as beliefs about the likelihood of various outcomes that might result

from the behaviors that a person might choose to perform, and the perceived values of those outcomes (McAlister et al., 2008). A semantic structure of outcome expectancies are "If (behavior), then (consequence)". For example, if I would stop smoking, then I would reduce my risk of lung cancer (Schwarzer & Fuchs, 1995). Demonstrating positive outcomes of performing a desired behavior boost self-efficacy (Schwarzer & Fuchs, 1995).

2.2.1.6 Self-Regulation

Self-regulation (self-control) is a personal regulation of goal-directed behavior. In this process people use their own thoughts and actions to reach the goal. Self-regulated learners identify goals and then adopt and maintain their own techniques for reaching the goals (Bandura, 1986)(Thompson et al., 2007)(Zap & Code, 2008). SCT identifies five ways in which self-regulation is achieved: (1) self-monitoring is a person‟s systematic observation of her own behavior; (2) goal-setting is the identification of long-term changes that can be obtained; (3) feedback is information about the quality of performance and how it might be improved; (4) self-reward is a person‟s provision of rewards for himself; (5) self-instruction occurs when individuals talk to themselves before and during the performance of a complex behavior (Bandura, 1991)(Bandura, 1997) (McAlister et al., 2008).

2.2.1.6.1 Goal- Setting

Goal setting, a key element in the self-regulatory procedure, provides a technique to alter behavior. The learners specify goals for their learning and then try to show, and control their cognitions, and behavior in order to achieve the goal (Thompson et al., 2007). Video games that help the players to regulate their own goals, motivation while playing game, enhance self-regulation skill(Zap & Code, 2008).

A goal setting procedure can consist of two phases: firstly, setting goal intentions (what an individual is trying to accomplish) and secondly the implementation of intentions

(specific scheme or plan that is designed to show how to achieve a goal.) (Thompson et al., 2007)(Baranowski et al., 2003). It is important to have specific goals than general ones, as they are more likely to facilitate behavior change because they are easier to be evaluated by the learners in the goal setting progress (Thompson et al., 2007)(Thompson, 2010). For instance, to promote a healthy diet, defining a goal like "make healthy choices" is too general, but a goal like "eating 1500 calories per day" is more specific enough and more effectual.

For example, EA Sports Active 2 video game (a game developed in physical activity area) permits the players to set their own goals (i.e., workout). Figure 2.3 demonstrates the goal screen, where the player can specify goals and plan a schedule of workouts to achieve his/her goal (Jane Lyons & Hatkevich, 2013).

Figure 2.3: Player-Centered Goal-setting Example (EA Sports Active 2 Game)

2.2.1.6.2 Problem-Solving

Problem solving, an important self-regulatory skill, produces personal relevant strategies to overcome barriers in order to achieve goals (Thompson et al., 2007). People usually test possible solutions in their minds or in thoughts and retain or discard them based on the consequences or outcomes they anticipated (outcome expectations) before performing the action (Bandura, 1986). An example of problem solving in video game will be shown in section 2.4.1.4.2 .

2.2.1.6.3 Goal-Review

Goal review helps people to evaluate progress towards goal attainment. Self-Monitoring (a person‟s systematic observation of her own behavior;) is a critical determinant of goal-review, since it provides information about goal progress and supports behavior change process (Bandura, 1986)(Thompson et al., 2007). Goal progress feedback is precious when people cannot define progress on their own (Schunk, 1995). For instance, a goal progress feedback is shown to the player in EA Sports Active 2 vide game to demonstrate the player‟s progress towards the selected goal (see Figure 2.4) (Jane Lyons & Hatkevich, 2013).

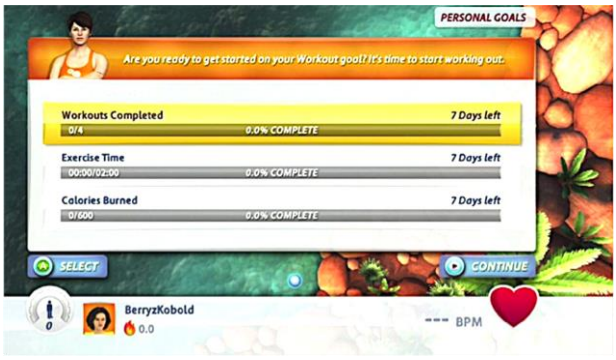

Figure 2.4: Goal-review example (EA Sports Active 2 game)

2.2.2 Cognitive Behavior Therapy (CBT)

Cognitive Behavior Therapy (CBT) is one of the best-researched and the most empirically supported treatment methods for adults and children (BREZINKA, 2008). The main idea of CBT is that emotions and behaviors are mainly affected by cognitions (thoughts, beliefs, self-interpretations of the situations in which they find themselves). In other words, psychological problems occur as a result of a way in which people interpret or evaluate situations based on their thoughts (Westbrook, Kennerley, & Kirk, 2011).

A non-cognitive viewpoint means that the same event would have to lead to the identical emotion for anyone who experienced that event. CBT says that when two people react differently to an event it is because they are seeing it differently (Westbrook et al., 2011). Assume, for instance, you are walking the street and you see your friend coming the other way, but she does not pay adequately attention to you. A various thoughts and some possible emotional responses may arise: Thought (1): „I can"t think of anything to say to her, she"ll think I"m really boring and stupid" (leading to anxiety). Thought (2): „Nobody would ever want to talk to me anyway, no one seems to like me" (leading to depression).

Therefore, the main principle of CBT is that one"s thoughts, not the external events, affect the way individual feels. In other words, it is not the situation that specify how one feels, but his/her perception (interpretation) of the situation. As a result, different interpretations or cognitions (thoughts) may lead to various reactions or feelings (emotions) in specific situations (see Figure 2.5) (Westbrook et al., 2011).

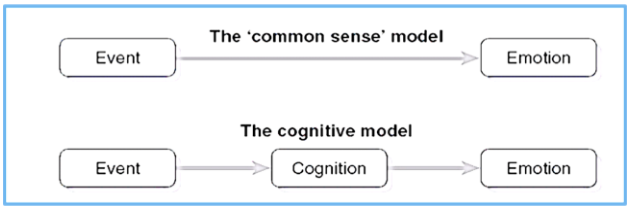

Figure 2.5: The basic cognitive principle

CBT has been found to be effective in treating psychological problems for children and adolescents in various areas such as the depression, anxiety, alcohol and drug use, sexual abuse, eating disorders and obesity (KENDALL, 2006). Cognitive-behavior therapy is an approach designed to alter negative thoughts in order to help patients to overcome emotional and behavioral problems. The goal of cognitive behavioral therapy is to identify and remove the negative thoughts and beliefs. The idea is that if people change the way they think, they can change the way they feel (KENDALL, 2006). Behavior is the outcome of cognitive process (i.e., how one interprets an event), one"s level of self-

efficacy in performing a behavioral response, and the consequence we expect (Bandura, 1977). Hence, two important methods can be followed for treatment including (1) evaluating and identifying how negative thoughts contribute problem behavior (cognitive therapy) and (2) creating learning experiences that will change the cognitive process, and in turn, behavioral pattern (behavior therapy) (KENDALL, 2006).

2.2.2.1 Cognitive Restructuring/ Reframing

Cognitive reconstructing is an important technique in CBT that helps individuals to reject unhelpful or faulty (inaccurate) thinking, with the goal of replacing positive, and rational thoughts. In this technique, the negative (maladaptive, distortion) thoughts can be recognized from different ways such as role-playing, questioning, and imagery and they should be challenged while positive or balanced or rational thinking (adaptive thoughts) should be encouraged (KENDALL, 2006). For instance if you attend a party where everyone is dancing and if your thoughts triggered in a negative way such as "I do not know how to dance", then you would feel sad and depressed. Instead, restructuring and replacing your thought with more positive such as "I want to learn how to dance" can help you to feel better.

A number of steps are involved in this technique (D. Burns, 1989). (1) One needs to identify the upsetting situation, (2) identify the exact negative feeling (i.e., annoyed, anxious, sad, regretful and so on) regarding to that event (emotional consequences) and rate each negative feeling for intensity on a scale (i.e., from F-1 (for the at least) to F-10 (for the most)), (3) identify the negative thoughts associated with the negative feelings, (4) analyze his/her atomic thoughts using cognitive distortion lists (see Table 2; page 104). Cognitive distortions (Negative Thoughts) are simply ways that our mind convinces us of something that isn‟t really true. These faulty thoughts are commonly used to reinforce emotions or negative thinking. For example, one might conclude that people are reacting negatively toward him/her when there is no evidence for this, (5) construct more realistic and balanced thoughts using one of the "10 ways to untwist his thinking" (see Table 3; page 106). For instance, a good way to evaluate the accuracy of thoughts might

be to ask some challenging questions such as “What is the evidence for and against my thinking ”, “Am I jumping to negative conclusion”, “If I were being positive, how would I perceive this situation?[8]” and “Is this way of thinking assisting me to reach my goals? ”(KENDALL, 2006) (Keith S. Dobson, 2010). For instance, when one names himself as „loser“, he should ask, “What is the definition of a loser?” Then, he will feel better when he discover that there is no such thing as a „loser“, and (6) evaluate this restructuring process in order to understand the present mood (how does one feel now). Rate again the intensity of the feelings. Are they less intense than originally? If the present mood is still not satisfied, return to step four to analyze these negative thoughts again.

2.2.3 The Relationship between CBT and SCT

A cognitive behavior therapy (CBT) is a combination of two theories: cognitive and a behavioral theory, which allows therapists to use both techniques to assist patients.

Behavioral theory is focused on the idea that people learn from the environment without consideration of their cognitions or thoughts. It proposes that only observable behaviors should be evaluated not cognitions and emotions (Watson, 1913). Hence, it can be defined in terms of learning theories. The goal is to reinforce desirable behavior while eliminate maladaptive ones. In this approach, many behavior techniques are used to change unwanted behaviors such as reinforcement (feedback) and modeling (observing a model to learn a behavior) (Watson, 1913). SLT as a kind of behavior theory emphasizes that reinforcement and modeling are important factors in the learning process (Bandura, 1994). SCT is a cognitive theory, evolved from SLT with more emphasis on the cognitive processes that affects learning.

Cognitive theory is an approach from psychology that attempts to explain human behavior by understanding the thought (cognitive) processes. The assumption is that in

[8] http://us.reachout.com/facts/factsheet/challenging-negative-self-talk

humans, thoughts or the one‟s interpretations of the situation are the primary determinants of emotions and behavior. Cognitive therapists believe that cognitions stimulate behavior and initiate the emotions (Bandura, 1994). Social Cognitive Theory (SCT) is also subcategory of cognitive theory emphasizing on the cognitive processes that affects learning (Bandura, 1986).

2.3 Health Behavior Change Video Games

Video games are a popular type of entertainment among both adults and youth (regardless of age and gender). Video games have some basic characteristics. For instance, all video games are guided by rules, provide challenge for the players and give them feedback on their progress and choices that enhance their advancement toward their goals (Thompson, 2012).

By feedback, players can learn what is valued by receiving rewards (e.g., gaining points) or punishments (e.g., losing points) for their decisions and performance. Serious video games (SG) are a special type of video games used for serious (e.g., pedagogical) purposes and not solely for entertainment. The term has been used to define a diversity of game types, particularly those related to e-learning, military simulation and medical training (Szczesna, 2011). Serious video games for health are a particular type in this area, which are designed to change health behavior of the players while entertaining them (Szczesna, 2011) (Thompson, 2010) (Thompson, 2012). For instance, diet and physical activity video games such as Squire‟s Quest! (SQ!) has been designed to educate children to learn about the consumption of fruit, vegetable and juice while they are entertaining by playing the game (Baranowski et al., 2003).

To design and develop serious video games for health, different categories of collaborators (i.e., game artists, software programmers, behavioral scientists) need to be involved to cover both the entertainment aspects, in order to motivate players to continue playing, and learning aspects, in order to provide an opportunity for behavior change. Hence, it is important to bring up the following: how to design serious video games for health that achieve the dual goals of entertaining (i.e., “fun-ness”) while promoting health

behavior change (Thompson, 2012) . The Re-mission digital game is an example of a successful serious video game in the health domain to alter player‟s behavior (Tate, Haritatos, & Cole, 2009) . Study result showed that playing Re-Mission considerably improved key behavioral and psychological factors associated with successful cancer treatment[9].

In the following, we will investigate Re-Mission [10] (a series of free online games designing with the same target as Re-Mission) in order to figure out what gaming elements could be effectual in designing such a successful serious game based. These games have used the Game Mechanics and Learning Mechanics Model (GM-LM) model that will be discussed as well.

2.3.1 Re-Mission Video Game

When considering the purpose and design of a serious game, a pedagogy-game mechanic mapping will be advantageous since it can be used to aid serious game design or game analysis (Lim, Louchart, Suttie, Ritchie, & Aylett, 2013). Game mechanics are designed to enable the players to interact with rules and more formally characteristics of a game such as game goals, player actions, strategies and game states to produce an enjoyable gaming experience (Lim et al., 2013). Learning mechanics indicate both learning and psychological impacts within serious game frameworks. For instance, repetition, guidance, instructional, feedback can be considered as learning mechanics in educational video games. The GM-LM model indicates how common game mechanics (i.e., rewards, cut scenes) in SGs can link to the learning mechanics as illustrated in Figure 2.6. For instance, several game mechanics including role-play, tutorial, and cascading information (Information released shortly to gain the appropriate level of understanding at each point during a game) can be applied to raise the player‟s comprehension in the game.

[9] http://www.hopelab.org/our-research/re-mission-outcomes-study/

[10] http://www.re-mission.net

To evaluate the player‟s progress several game mechanics such as action points (it is the way that can control what the users may do during their turn in the game by allocating them a budget of „action points‟ (Lim et al., 2013)), rewards, and penalties can be applied in the serious game, which corresponds to the learning mechanic (i.e., assessment). Re-Mission game play loop according to the GM-LM model is indicated in Figure 2.7. In the next part, Re-Mission game is played to elaborate more on mapping and relationship between the game mechanics and learning mechanics.

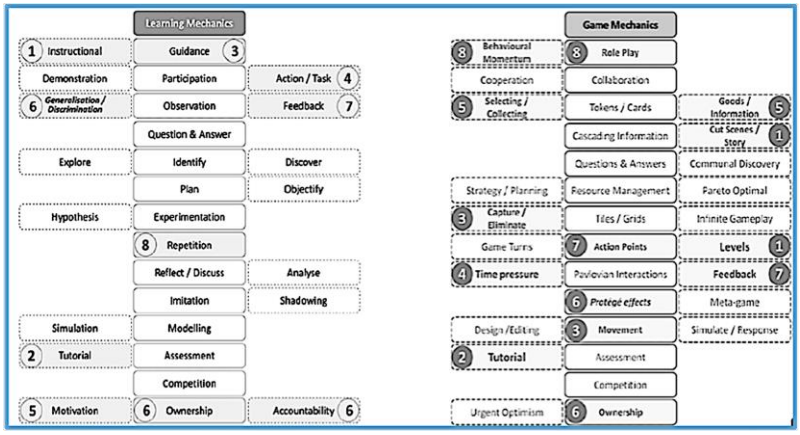

Figure 2.6: GM-LM model (Lim et al., 2013)

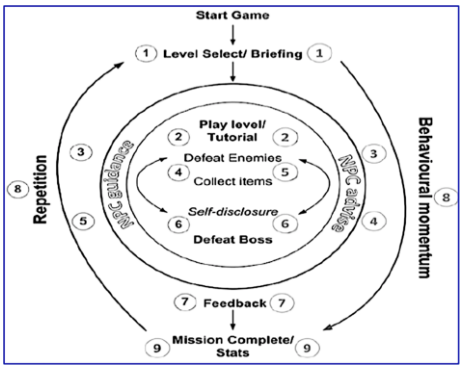

Figure 2.7: Game loop (Re-Mission Game) (Lim et al., 2013)

2.3.1.1 Re-Mission Game Play Scenario

In this section, Re-Mission2 game is played to elaborate more on mapping and the relationship between game mechanics and learning mechanics. Re-Mission 2[11], is a series of free online games, a third person shooter (TPS) genre, designing with the same target as Re-Mission (the first version). In this game, player is placed inside of the patient‟s body to fight with cancer, equipped with weapons like chemotherapy[12]. This scenario corresponds to the Re-Mission game play loop (see Figure 2.7). In the following part, all the game mechanics used in Re-Mission 2 are listed to clarify how they are applied in the game and mapped to the learning mechanics.

2.3.1.1.1 Cut scene/ Back-story and Levels (Symbolized Number 1)

Game is triggered with a backstory to tell the player what the mission (i.e., shoot cancerous forces) and his/her role (as Nano-Boto) are in this game (see Figure 2.8). In this part, the game teaches or instructs the player about the specific learning objective (i.e., fight with cancer through destroying cancer cells by following prolonged chemotherapy treatment). Hence, cut scene as a game mechanic (symbolized with number 1 in Figure 2.6) corresponds to the instructional leaning mechanic (symbolized with number 1 in Figure 2.6). Next, the player selects a level and advances through the game by completing a series of level sequentially (see Figure 2.8).

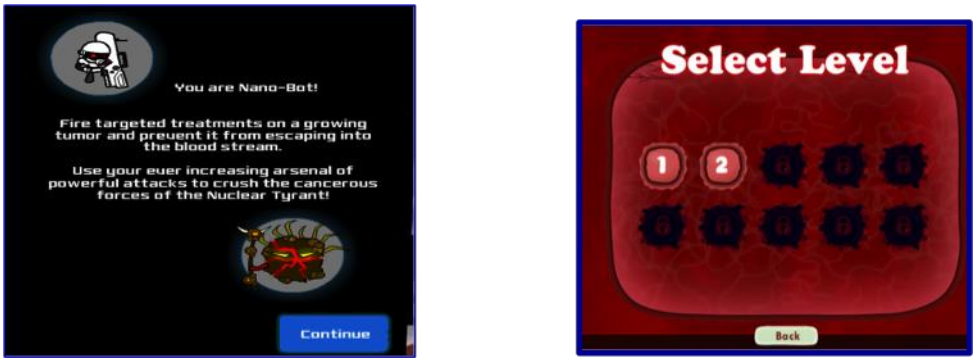

Figure 2.8: Cut Scene and Level Game Mechanics

[11] http://www.re-mission.net

[12] http://www.re-mission2.org/#/research

2.3.1.1.2 Tutorial (Number 2)

In each level (before starting the game play), the player is guided through NPCs (i.e., Stromal guides the player (NonoBot) that he is slowly increases the health of everyone on the same floor to a maximum of 10 points as illustrated in Figure 2.9. So the player is guided to gain adequate knowledge about various types of cancerous forces and learns how to prevent cancerous cells from escaping into the blood stream at different levels. The game mechanic (i.e., tutorial) is applied to raise the player"s comprehension in the game, which corresponds to the guidance and tutorial as learning mechanics (symbolized with number 2 and 3 in Figure 2.6).

Figure 2.9: Tutorial Game Mechanic

2.3.1.1.3 Selecting/ Collecting, Cascading Information, and Time Pressure (Number 5, 5, 4)

Selecting or collecting (number 5) as a game mechanic is used in this part to show different categories of weapons or powers (see Figure 2.10), which will be picked up by the player in order to be used in the next part of the game, where the player has to kill or shoot cancerous forces. Chemobloast is an example of powerful weapon. Cascading information game mechanic (short information to increase the player"s understanding at each point; number 5) is also shown regarding each weapon (i.e., Use your powers to level them up) (see Figure 2.10). Next, the player (NonoBot) has to perform interactive in-game task such as eliminating or shooting enemies under a certain time (time pressure

game mechanic; number 4) (see Figure 2.11), which matches to action/task learning mechanic (number 4).

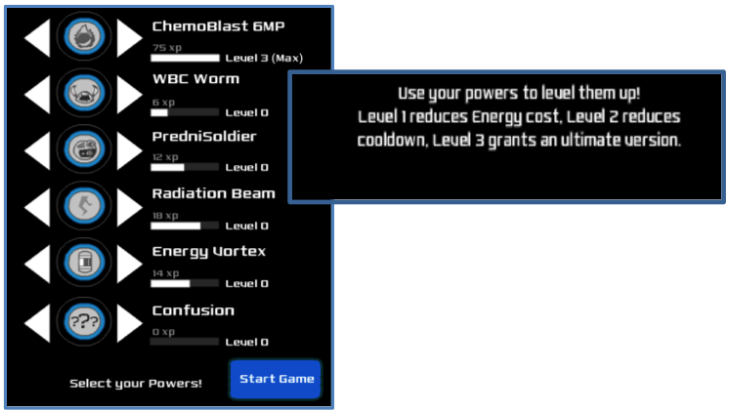

Figure 2.10: Selecting and Cascading Information Gaming Mechanics

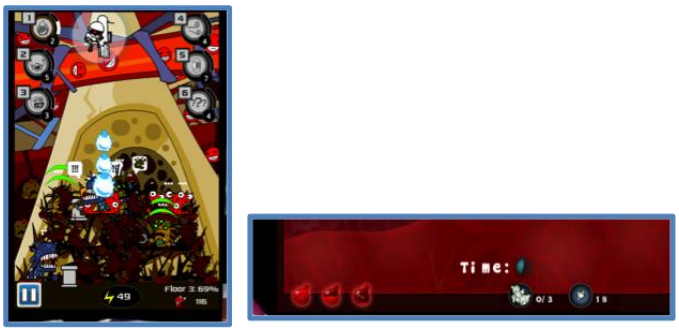

Figure 2.11: Shooting Enemies Under a Certain Time

2.3.1.1.4 Protege Effect (Number 6)

The protégé effect creates a motivation to the players to work harder for their avatars than themselves; it is advantageous for learning and engagement (Lim et al., 2013). In my view, the player in Re-Mission 2 will be engaged (motivation as learning mechanic) to follow the prolonged chemotherapy in real situation since he/she is capable to evaluate the consequences of poor medication behavior in the virtual world. In other words, the players can create outcome expectations about the consequence associated with a behavior, which refers to outcome expectancy (see section 2.2.1.5). For example "IF the

patient skips chemotherapy doses, THEN Roxxi‟s chemo concentrating blaster misfires every third shot cancer cells survive and become drug resistant”(Tate et al., 2009).

2.3.1.1.5 Feedback and Status (Number 7, 9)

Feedback indicates the player what they have just done, and gives them quick enjoyment of things occurring after they have accomplished a task successfully. It permits the player to feel understood by the game (Lim et al., 2013). The players receive either positive (i.e., congratulation message like victory) or negative feedback such as “OH NO!” at the end of each level as shown in Figure 2.12. Status is also considered as a kind of feedback, which is exhibited at the end of each level (see Figure 2.13). This status is a kind of evaluative feedback on the player‟s performance toward the goal (i.e., goal: defending the blood vessels from Nuclear Tyrant‟s minions) and positive feedback (i.e., great work). This corresponds to the feedback-learning mechanic.

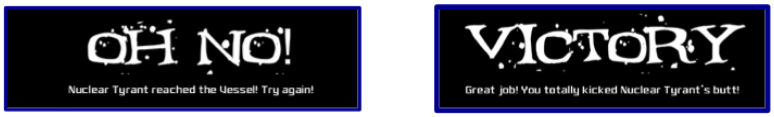

Figure 2.12: Feedback

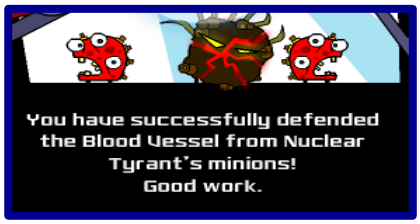

Figure 2.13: Status

2.3.1.1.6 Action Point (Number 7)

An action point is the control what the user may do during their turn in the game by allocating them a budget of „action points“ (Lim et al., 2013). In Re-Mission 2, the score is shown at the end of each level (i.e., score is 2000), which is another type of feedback (see Figure 2.14).

Figure 2.14: Scoring System (Action Point Game Mechanic)

2.3.1.1.7 Rewards (Number 7)

Reward is a feedback given to the player due to the worthy action. It is used to encourage the player to progress in the game (Lim et al., 2013). For example, the player receives healthy cells if he could play a level successfully. They can be spent to buy staff such as atomic energy drink (see Figure 2.15).

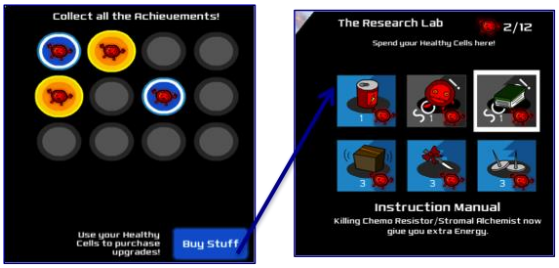

Figure 2.15: Reward Game Mechanic

2.3.1.1.8 Behavioral Momentum (Number 8)

Behavioral Momentum is used to give confidence and motivate the players to continue the game (Lim et al., 2013). Re-Mission 2 is a repetitive game play (it consists number of repetitions of some levels) to reinforce behavior change for the player (Lim et al., 2013).

2.4 Escape from Diab Video Game

Escape from Diab is a serious game in health domain from the action-adventure type in a third person perspective. It has been designed to prevent obesity and consequently reduce the risk of diabetes by changing the player‟s behavior toward increasing the consumption of fruit, vegetables and physical activities. It is not available to play because it is still under clinical test and not released freely to play (Thompson, 2010).

Escape from Diab game is described in this section since SCT plays a major role in the pedagogical framework of this game. It is stated that how this game was designed based on behavior change components of SCT. Behavior is a complex process and it is sometimes difficult to be changed at once. Hence, SCT explains that cognitions (such as self-efficacy, knowledge) simulate behavior and initiate the emotions (Bandura, 1986). For instance, to increase the consumption of vegetables (desired outcomes), mediators (cognitive factors) such as self-efficacy and knowledge should be changed (see Figure 2.16).

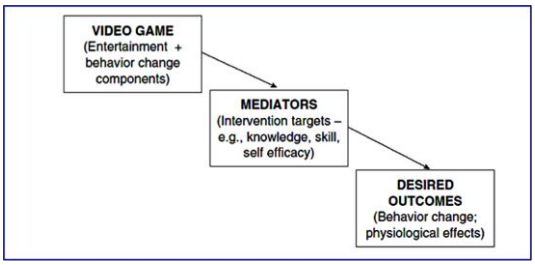

Figure 2.16: Behavior Change Framework (Thompson, 2010)

2.4.1 Behavior Change Procedures

Video games provide the environment where the player can attain useful knowledge and skill (such as self-efficacy) by means of behavior change factors including goal setting, modeling, feedback, mini games, and so on. Therefore, behavior change components may influence mediators (i.e., self-efficacy) and consequently leading to behavior change.

Behavior change components and mediators that belong to SCT (related to Escape from

Diab video game) are presented in Figure 2.17 (Thompson, 2010). In the following, we will describe each component separately.

	SCT
Change procedures	
Storyline	×
Mini-games	×
Modeling	×
Feedback	×
Choice	
Value-reason statements	
Tailoring	
Good guy/bad guy	
Goal setting	×
Implementation intentions	×
Self-monitoring	×
Goal review	×
Problem solving	×
Mediators	
Immersion	
Attention	
Knowledge	×
Self-regulatory skill development	×
Personal mastery	×
Self-efficacy	×

Figure 2.17: Behavior Change Factors in Escape from Diab Game based on SCT

2.4.1.1 Storyline

In this part, we will discuss how the story can be effective in order to change the player‟s behavior and then we will present how storyline element are applied in Escape from Diab. Many video games are based on a story, or narrative. Story immersion is a mechanism that affects player‟s cognition, emotion, and potentially health behavior (Lu AS, Baranowski T, Thompson D, 2012)(Thompson, 2012).

Immersion is a process in which people travel into the story world and are changed by the journey (Lu AS, Baranowski T, Thompson D, 2012). There are at least three ways by which story may affect people: (1) immersion assists with suspension of disbelief, which means that a person puts aside his doubt about a story, even if that story has crazy fantastic stuff like talking cars, vampires and etc.; (2) narrative experience may become a personal experience. When people feel they have experienced events depicted in a narrative, their attitudes change based on the story. Moreover, an exquisite health narrative may lead to a sense of direct experience as if people feel that they had actually performed the health behavior; (3) character and plot are the substantial factors of

narrative and immersive quality (Lu AS, Baranowski T, Thompson D, 2012). A hypothetical model for the mechanism of story immersion of health games is depicted in Figure 2.18 (Lu AS, Baranowski T, Thompson D, 2012).

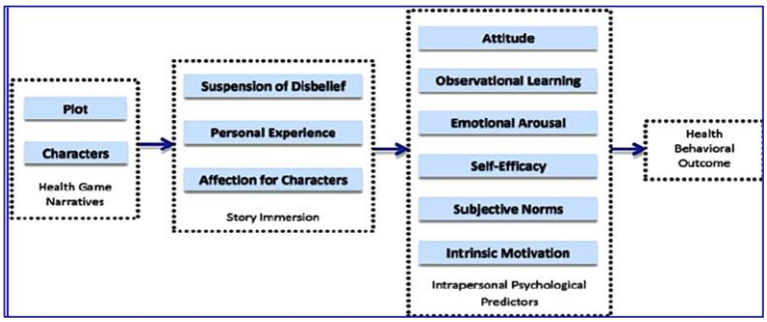

Figure 2.18: A Hypothetical Model for the Mechanisms of Story Immersion of Health Games

In Escape from Diab game, entertainment was imposed mainly through the storyline and characters. Deejay, one of the protagonists (the story character who takes the leading part in a drama), is an athletic youngster in the world of Diab, a fictional city where people only eat junk food. In the story, Deejay finds friends and together they make plans to escape from Diab to Golden City, a place where people eat healthy foods and exercise. On the other side, King Etes, the antagonist (the story character in opposition to the protagonist, called Diab‟s evil), attempts to increase unhealthy diets and to capture DeeJay. The narrative part of this video game was written by professional writers in order to engage and immerse adolescents and children into the game. The game consists of nine sessions. Each session has a cut-scene (cut scene was introduced in Re-Mission game; see section 2.3.1.1.1) storyline. For instance, in session 2, DIAB kids are walking through food depot where robots are carrying out boxes of fruits and other foods. Then, DIAB kids explain to Deejay how they don‟t have time to eat right in the early morning, and then Deejay tries to point out ways to do it.

2.4.1.2 Modeling

Observational learning was elaborated in section 2.2.1.1 . In Escape from Diab, players learn by observing the model performing the behavior to overcome barriers during the game play. In this scenario, DeeJay acts as an expert on healthy diet and physical activity. Therefore, he is considered as a mastery model that provides information related to healthy diet and physical activity to the player.

2.4.1.3 Feedback

Feedback is a kind of reinforcement that is embedded in the game flow to demonstrate the player‟s action based on the decisions they made during the game. Positive (i.e., "Grate job"," congratulation") and meaningful feedback raises self-efficacy. For instance, DeeJay (model) gives evaluative and positive feedback when the player performs a goal/task successfully (i.e., you did it, great). In one part of Escape from Diab, players must recognize fruit boxes from non-fruit objects. When they select boxes, a score sheet will appear for them on the screen to provide instance feedback. Specifically, all the correct answers are emphasized with a green check mark while incorrect answers appear with a red mark.

2.4.1.4 Self-Regulatory

Characters during the Escape from Diab video game try to demonstrate how to attain the goal and change behavior if success is not achieved immediately by using self-regulatory skill (Thompson, 2010). Self-regulatory skill in this game is improved through goal setting, problem solving, and goal review process respectively (Thompson, 2010).

2.4.1.4.1 Goal Setting

In Escape from Diab, players have the freedom to select the type of goal they like to work with, based on physical activity and diet goals (level 1 to 4 for diet and level 5 to 8 for physical activity). Consequently, autonomy will be enhanced by giving players the opportunity to choose the goal they are more likely to work with and to have control over the game. Examples of goal setting, including goal intention and implementation intention are illustrated in Figure 2.19. For instance, a specific goal, defined as "eat bananas for breakfast" has several plans. These plans are shown to the player from which he chooses one which is most appropriate for him to achieve his goal. In way, the connection of the goals to personal values is created.

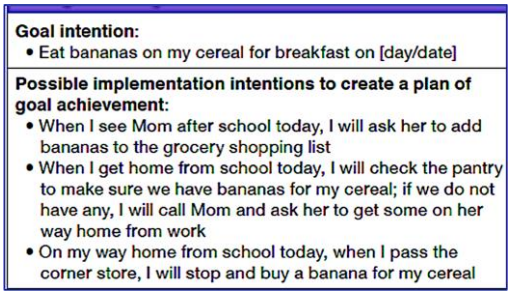

Figure 2.19: Example of implementation intention (Escape from Diab)(Thompson et al., 2007)

2.4.1.4.2 Problem- Solving

Escape from Diab game allows players to choose a possible barrier they anticipate they may meet (i.e., do not always have bottled water at home) achieving the goal (i.e., drink one more glass of water on Thursday and Fridays). Possible solutions are shown to the player to choose the best one (i.e., ask parents to buy bottled water). Then, the player receives an evaluative feedback to specify whether the goal is met or not (i.e., cool! You have figured out how to successfully meet your goals) (see Figure 2.20)(Thompson, 2010) .

Figure 2.20: Example of problem solving in Escape from Diab

2.4.1.4.3 Goal Review

Goal review has been designed to evaluate progress towards goal attainment . For an attained goal, players receive a reinforcing statement to enhance self-efficacy and internal motivation. Alternatively, if goal is not met, players will be redirected to a problem-solving phase where they can re-try to reach the goal again. This activity enhances personal mastery, which increases self-efficacy (Thompson, 2010).

2.4.1.5 Self-Efficacy

In Escape from Diab, positive and informative feedback that are transmitted through character‟s dialogue (e.g., “I did it!”), character interactions (e.g., DeeJay congratulating other characters for successfully performing a behavior or achieving a goal), and body languages likely enhance self-efficacy (Thompson, 2010) . Observing a mastery model that performs a task successfully will raise the player‟s self- efficacy.

2.4.1.6 Knowledge

Knowledge is embedded in the game from DeeJay. He is the expert on healthy diet and physical activity, who provides practical knowledge relating to diet and physical activity behaviors. In addition, mini games play an essential role for converting knowledge to the players. For example, players realize which foods are fruit and vegetables and which are not by playing mini games. By this way, players learn the content while entertained by playing mini games (see Figure 2.21) (Thompson, 2010).

Figure 2.21: Mini Game in Escape from Diab Game

2.5 Background Summary

In this Chapter we discussed two important behavior change theories named SCT and CBT. From a SCT perspective, modeling and feedback are important elements for learning the behavior and personal factors (cognition) including self-efficacy, outcome expectations, behavioral capabilities, and self-regulation have the important influence on behavior change or performing new behavior (Bandura, 1997). The relationship between cognition, event, and emotion, which is the main basic principle of CBT, was explained (see section 2.2.2) (KENDALL, 2006). Cognitive restructuring (reframing), which is an important technique in CBT was examined (see section 2.2.2.1)(D. Burns, 1989). This

technique is used for altering negative thought patterns by replacing them with positive and realistic ones. Re-Mission2 game was played to understand how gaming mechanics could be mapped into the educational aspects (see section 2.3.1.1). Escape from Diab game was studied to examine how behavior change components related to SCT can affect the player‟s knowledge and skill to change the behavior (see section 2.4).

Chapter 3

Analysis of Reach Out Central Video Game

In this Chapter, we analyze the Reach Out Central (ROC) game, the game selected to be modeled in ATTAC-L. We also want to figure out the behavior change factors that have been used to induce behavior change, as we want to investigate how this can be modeled with the ATTAC-L language. The theoretical foundation model used to improve the mental health problems of young people in ROC is based on Cognitive Behavior Theory (CBT). Social Cognitive Theory (SCT) is also mentioned as another comprehensive model for behavior change in this game but not explicitly (J. Burns et al., 2010). The concepts of SCT and CBT along with serious game examples were discussed in Chapter 2. We will first elaborate on the game itself, and then analyze ROC from the perspective of CBT and SCT.

3.1 Reach Out Central Video Game

ROC is a single-player, role-playing, story-based and adventure online video game and can be played free of charge. It is a health behavioral change serious game aiming to promote the mental health of young people. Targeted towards age group 16-25 years old, especially men. It promotes developing life skills to manage depression, coping with anxiety, and preventing poor health outcomes. In this game, players are given the opportunity to try real life scenarios and situations where they can observe how their thoughts, feelings and actions can affect each other. The theoretical model of this game is

found to be the combination of SCT (Social Cognitive Theory), and CBT (Cognitive Behavior Therapy)(J. Burns et al., 2010).

The player takes the role of the main character who is new in a town. He interacts with several non-player characters (NPCs) through various plots (discrete storylines that usually involve up to five characters). Hence, it is up to him/her to work out how to settle, make new friends, and find his way around the place. The goal is to discover the choices he makes about friends, partying, how work and life can impact on his wellbeing and relationships (J. Burns et al., 2010).

Chris is one of the major characters (the cousin of the player in the story) who lives in this new city and introduces the player to all his friends: Davo, Kate, Julie, Tim, Jason, and Trish. Consequently, the player starts communicating and chatting with the new people and gets involved in their stories. The narrative part of the game invokes the player‟s emotions by using imagination and fantasy and involves the player into participating actively in challenging real-life situations. This way, players could learn how to socialize and make new friends in a new city, how to behave and support a friend who messed up since he lost someone, or how to deal with a breakup situation and so on.

3.2 Cognitive Behavior Therapy (CBT)

CBT was discussed in Chapter 2, section 2.2.2 In this segment, ROC is analyzed focused on CBT. The main principle of CBT is that individual‟s thoughts may affect emotions and behavior. Therefore, it is important for people to discover the relationship between them because a way in which people think will change feeling and behavior. ROC gives the opportunity to explore the relationship between thoughts, feelings and behavior, which is the main basic principle of CBT. Players deal with different situations in the form of story in order to discover the way they think, feel, and behave.

3.2.1 Situation (Event)

In this game, the players are confronted with two types of challenging situations in the context of the story. She/he (main character) encounters with real life problems such as breakup, parental divorce, how to find a whole set of new friends, and etc. For instance, the player will experience the situation, where his parents are getting divorced.

The second type of situation is when the player should help out NPCs in order to make progress in the game. For example, Tim is a NPC who is a victim of bullying or light joking from the Chris (player‟s cousin). In this way, the player can learn what the bulling is and how to support his friend and gain adequate knowledge and skill about the proper behavior in different situations.

3.2.2 Cognitive Restructuring

Cognitive restructuring is an important strategy in CBT that helps individuals to reject unhelpful or faulty thinking and replacing them with more positive, and rational thoughts (KENDALL, 2006)(D. Burns, 1989). The six steps were discussed (see section 2.2.2.1

Considering a scenario in ROC, where the player deals with a breakup situation. In the context of the story, the player receives a message on his/her computer from his partner that informs him about the breakup. As a result, the player identifies the situation as shown in Figure 3.1.

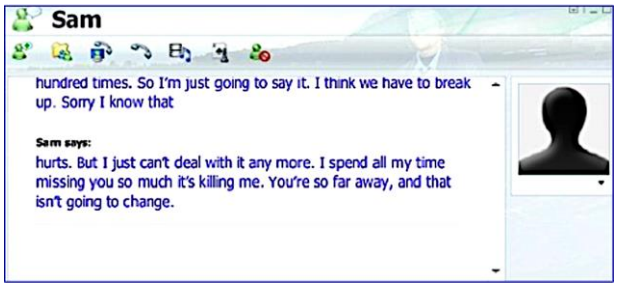

Figure 3.1: Breakup Situation

In this case, the mood meter (see section 3.2.4.2 , Fig 3.9) shows that the player is unhappy. In way, the player identifies his negative feeling (i.e., sad, stress) related to this upsetting situation. Afterward, Paul (player‟s brother who is a trainer or consoler) makes a call to the player by means of the mobile phone (mobile phone is integrated in ROC) to talk the player. The player explains the situation to Paul. Then, three options are shown to the player to describe the breakup situation for Paul as follows (the player must select one of them) (see Figure 3.2):

-I don‟t really know, my girlfriend just said it was too hard.

-My girlfriend must have met someone else I guess, did not take long.

-I guess my girlfriend finally realized I‟m a loser.

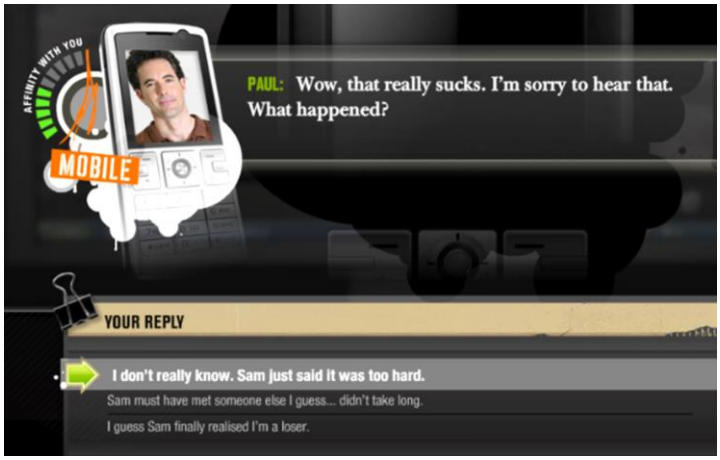

Figure 3.2: An Example of Conversation between Paul and the Player

Both negative (hot) and logical thoughts are shown in the form of multiple options to the player. In this example, the second and third option shows cognitive distortions (negative atomic thought). In the second option, the player criticizes his partner with “Must” statements and jumping to negative conclusion without definite evidence. This corresponds to the number 5,and 8 (see Table 2, Page 104)(D. Burns, 1989). In the third one, the player is labeling himself as a „loser“ and blaming himself for something he was

not entirely responsible for. This corresponds to the number 9,and 10 (D. Burns, 1989) (see Table 2, Page 104). Consequently, the player can discover his negative thought based on his choice.

In the next part, a feedback based on the player‟s answer is shown either in the form of ROC narrator (see section 3.2.4.1) or scoring system (see section 3.2.4.3). In a way, the player learns more about rational and logical thoughts. In this case, the player receives feedback ("i.e., you are jumping to negative conclusion, do you have any evidence to support your view?") in response for the second option. The goal of these feedbacks are to help the player identifying the evidence that contradicts the NATs or identifying balanced thoughts about the situation.

In the last phase, Paul suggests the player to do something new such as doing exercise in order to avoid being depressed. If the player‟s answer is positive in response to the Paul‟s suggestion, then his friendship rating score (another type of feedback; see section 3.2.4.3) with Paul will be raised; otherwise will be decreased (see Figure 3.3). Hence, in ROC, the player learns to identify, test, and evaluate the outcome of their own negative thoughts in a certain situation by receiving various feedbacks from the game.

Figure 3.3: Conversation between Paul and the Player- corresponding feedback (scoring system)

Last but not least, the mood tracker is a series of questions that is given to the player whenever the player logs into the game in order to evaluate the player‟s feeling in real life situation as long as he is playing the ROC game (see Figure 3.4). It can assist the player in building a meaningful connection between the game experience and real life.

Figure 3.4: Mood Tracker

3.2.3 Modeling

Modeling is the strategy in which the player learns how to perform a task by observing a model (Jane Lyons & Hatkevich, 2013).

In ROC, there is a major non-player character, namely “Paul”, who is the player‟s brother in the context of the story. Paul communicates with the player regularly after or before a certain scenario (i.e., breakup, parental divorce, etc.). He mostly acts as an adviser or trainer who provides instruction and adequate information to the player (similarly to Deejay in Escape from Diab game; see section 2.4.1.2). Paul sometimes describes that he had the same situation or problem (i.e., breakup) as the player and he could cope with the challenging situations successfully by performing positive activities. For instance, in the breakup scenario, Paul explains that after a breakup, it is really good to do an activity, do something positive, make some plan for the future, and exercise. He explained how he could overcome depression and feel better by performing these activities. Figure 3.3 illustrates a part of dialog between the player and Paul. This shows that Paul encourages the player to do something new to avoid being depressed after breakup.

In this game, Paul does not perform an activity in order to be observed by the player. But he acts as a knowledgeable person who instructs the player to attain the adequate knowledge and skill. In Chapter 4, section 4.1.4.2.1 , we will design a scenario in such a way that Paul would be capable to demonstrate the right behavior to the player.

The player can also learn about emotion, and the desired behavior of a specific problem (i.e. losing someone, unexpected pregnancy) by observing (helping) other NPCs (i.e., Tim, Juli). Player may indirectly experience the entire scale of challenges and expectations of a certain behavior and while obtaining knowledge and skills required to successfully accomplish the behavior. They can be considered as coping models because NPCs are no expert and they make mistakes and show possible fears of observer but eventually they present the right behavior. In this part, the player must help other NPCs while obtaining knowledge and skills.

For example, Tim is a character who is being joked by Chris and Dave (NPCs) because he wears makeup and has a specific style of clothing (he is a member of a rock music band). Sometimes Tim makes the light jokes worse for himself by taking them so seriously while they are not always meant maliciously. Tim acts defensive and sometimes aggressive in this situation. So, the player learns that this situation is tough situation and is not always funny since he could observe that Tim was pretty sad. The player also learns laughing these things off can be a better response than getting angry or upset by observing Tim. Chris (the guy making jokes) apologies to Tim at the end of the scenario (showing the right behavior). In Figure 3.5, Tim thanks the player because Chris realizes how much it hurts Tim by talking to the player.

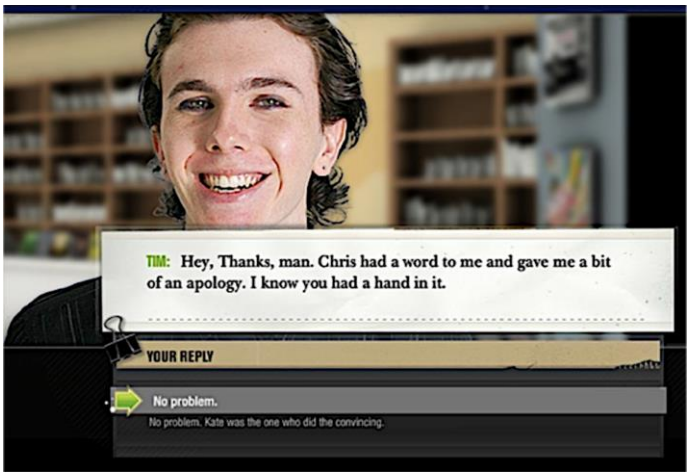

Figure 3.5: Tim (NPC) (a guy being joked)

3.2.4 Feedback

Reinforcement (feedback) is the response, either positive (i.e., reward, encouraging statement) or negative, given to a person‟s behavior that will increase or decrease the likelihood of change of behavior (McLeod, 2007). Feedback as a learning mechanic is an advice on performance so that the learner has a better understanding of values, standards, criteria, and so on. It is linked with formative assessment (Lim et al., 2013). Feedback as gaming mechanic is the information that is shown to the players to inform them what they have just done, which permits the player to feel understood by the game (Lim et al., 2013). Feedback is a main source of self-efficacy information (Schunk, 1995)(Baranowski et al., 2008), which can be classified into various types including verbal persuasion (a feedback that encourages the learner such as “you can do it”, “you did great”), informative (specifying the information that can be provided as feedback) ,performance (indicating that individuals are performing well or making progress such as “you're good at this”), and goal progress or evaluative (a feedback that provides information about progress toward goals)(Schunk, 1995). In the following, we discuss the different types of feedback used in ROC.

3.2.4.1 ROC Narrator Feedback

The ROC narrator (called crew in ROC) feedback is a written feedback that indicated as a **response** to the player‟s performance. This feedback appears either positively or informatively to the player, which can correspond to both game and learning feedback mechanic (see Figure 2.12).

Let‟s consider a scenario called “New Kid in Town”. In this plot, the player moves with his mother to a new city. Accordingly, he has to adapt himself to the new situation and find a whole set of new friends, which can be a challenging situation. During the story, the player is informed by Chris (the player‟s cousin) about the reason of his moving since Chris‟s mother couldn‟t take care of the grandmother by her own and needed help from the player‟s mother.

Following, several options are offered to the player as shown in Figure 3.6. If the player selects the first option that supports the realistic thinking („yes, no offence. It sucks but it is for a good reason“), he will receive the positive (encouraging) statement or feedback (see Figure 3.7). The second and third options support negative thoughts (cognitive distortion). As a result, the player will receive the informative feedback. This way, ROC informs the player about the consequence of his action by giving useful information to him (the player is informed about the type of his negative thought. i.e., jumping to the negative conclusion without evidence) (see Figure 3.8).

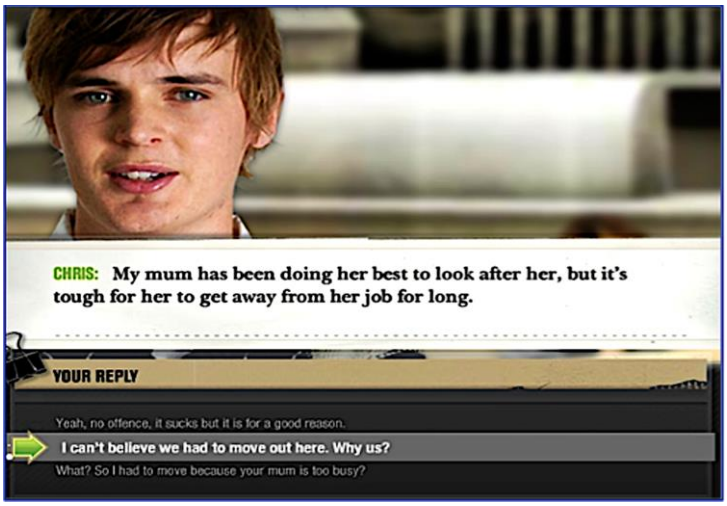

Figure 3.6: Conversation between Chris and the Player

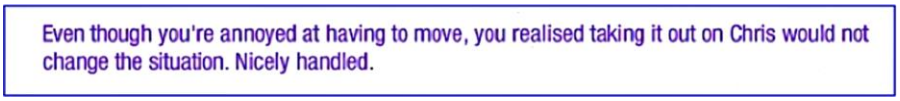

Figure 3.7: Positive Feedback from ROC Narrator

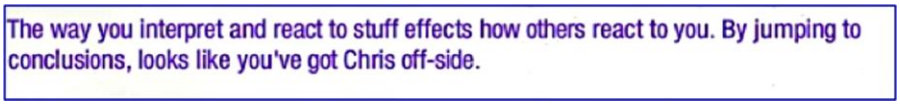

Figure 3.8: Informative Feedback from ROC Narrator

3.2.4.2 Mood Meter

The mood meter is a tool designed in the ROC game to present the player‟s feelings in response to his action in a situation during the game (i.e., when the player selects an option supporting cognitive distortion or NT). This element can be defined as a game mechanic to help the players understanding the emotional consequences in dealing with challenging and tough situation. It can be useful for achieving the learning objective (cognitive restructuring). For example, the mood meter shows that the player becomes sad and stressed after breaking up with his partner (see Figure 3.9). The player‟s in-game mood meter also affects the course of the game. If for example happy and confident is

green, then the player will have more conversation with other characters, which enhances interactivity in the game.

Figure 3.9: Mood meter

3.2.4.3 Scoring System

The scoring system is the main evaluation and assessment of the player‟s progress toward the goal in the ROC game. It is a game mechanic, which follows action point system and corresponds to assessment as the learning mechanic (see Figure 2.14). In this game, the player is scored **on** the friendship with other characters. Friendship rating is a system to illustrate the degree of the player‟s friendship with other major characters. If the player performs an appropriate behavior towards others, the friendship rating will be increased, otherwise it will be decreased. For instance, the player stood up for Tim (Chris‟s friend) while being teased by other friends. Therefore, his/her friendship rating with Tim is raised (see Figure 3.10). This way, the player is reinforced positively or encouraged to perform the desired behavior in a real life situation. In this example, the player also receives very positive and encouraging (verbal persuasion) feedback from ROC narrator as shown in Figure 3.10.

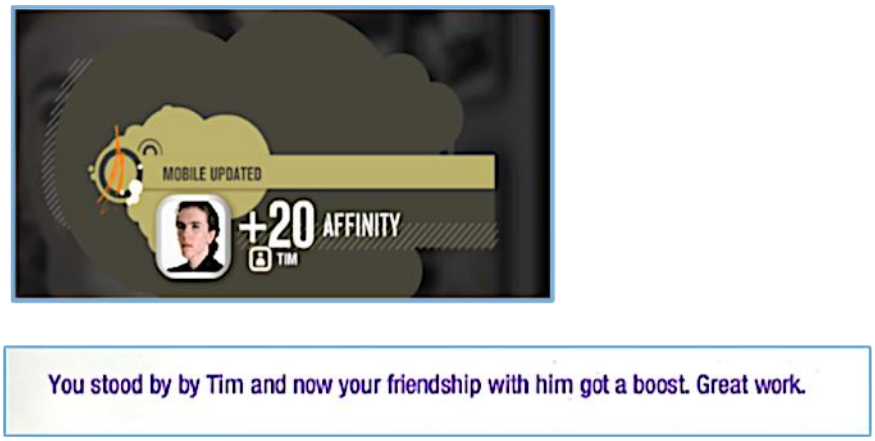

Figure 3.10: Scoring System and Positive Feedback

3.2.4.4 Reward

The player is given various rewards (i.e., money, music CD) during the game for his worthy action. For instance, his mother gives money to him, for hanging out with friends, when he acts positively in dealing with challenging situation as shown in Figure 3.11.

Figure 3.11: Reward - ROC narrator Feedback

3.2.4.5 Character‟s Feedback

Another feedback in the ROC game is the response received from other characters in the context of the story. The players receive the feedback from NPCs by means of dialogues and facial expressions. For instance, when the player assists Anne in finding her handbag, she gives positive feedback by a dialogue “Thank you so much that is awesome” and a smile on her face (see Figure 3.12).

Figure 3.12: Ann’s (NPC) Feedback

3.3 Social Cognitive Theory (SCT)

Reinforcement and modeling are the most important behavior change components of SCT. Besides, SCT emphasizes on cognitive process of people (personal factors) including self-efficacy, outcome expectations, and self-regulation that influence the behavior and learning (McAlister et al., 2008)(Bandura, 1986).

SCT proposes that behavior modification is based on enhancing skills and confidence (**self-efficacy**) in performing the new behavior, while **modeling** and **feedback** are foundations for learning skills (J. Burns et al., 2010)(Baranowski et al., 2008).

Modeling and reinforcement were discussed in preceding sections. Self-efficacy, behavioral capabilities (knowledge), and self-regulation will be discussed in the subsequent parts with respect to ROC.

3.3.1 Boosting Self-Efficacy

Models can have the influence on self-efficacy profoundly. If one knows what to do to perform a behavior or task by observing competent model, then he has more self-efficacy to preform actions successfully (Schunk, 1995). In the ROC game, Paul as a model explains the desired behavior and provides informative knowledge for different situations to the player. This leads to boost the player‟s level of knowledge and consequently self-efficacy for doing the desired behavior (see section 3.2.3).

Objectives or goals have also influence on behavior by means of their effects on cognitive and motivational aspects. Goals motivate and engage individuals to use their efforts to meet task demands and may experience a sense of self-efficacy for achieving the goal (Schunk, 1987). Objectives are shown to the player in the ROC game (see section 3.3.3.1). They can help the players to focus on the goal and select appropriate strategies (by choosing the best options) to achieve the goal. This will raise the player‟s self-efficacy during the game.

Demonstrating positive outcomes of performing a desired behavior boost self-efficacy (Schwarzer & Fuchs, 1995). In ROC, the player receives positive feedbacks in various formats including reward (see section 3.2.4.4), encouraging (persuasive) statement (see Figure 3.7), scoring system (see section 3.2.4.3), and the mood meter (see section 3.2.4.2).

Positive mood (feeling) enhances self-efficacy, while negative diminishes it (Bandura, 1997) (Pajares, 2001). The Cognitive reconstructing technique is used in ROC (see section 3.2.2) to instruct the players identify their negative thoughts and associated negative feelings and replacing them with more positive, and rational thoughts in order to boost their positive moods. Mood meter (see Figure 3.9) is a tool that helps the players to keep track the level of confidence. Obviously the high level of confidence in the mood meter indicates high self-efficacy while the high level of stressed and scared feelings show a low-level of the self-efficacy. The game players also get game tips to perform several positive activities in order to raise the positive feelings, which consequently increase the self-efficacy as demonstrated in Figure 3.15.

3.3.2 Knowledge

Acquisition of functional and behavior-specific knowledge and skills is an elementary component of behavior change (Bandura, 1986) (Thompson et al., 2007). In this section, we illustrate factors in the game that help the player to increases his knowledge during the game play.

3.3.2.1 Tutorial

The ROC game provides a method to convey the information to the players by talking to Paul regularly using the in-game mobile phone (see Figure 3.3). Paul acts as a trainer or consoler as we discussed in the modeling part. The player receives calls from Paul when he deals with a certain situation or scenario that needs to be guided. For instance, the player gets acquired information from Paul about how to deal with the breakup situation and avoid becoming depressed. This part can correspond to the tutorial (as game and learning mechanic) and guidance (as learning mechanic) since a NPC (Paul) takes on the role of trainer guiding the player through different scenarios and the player merely acts as an observer.

3.3.2.2 Cascading Information

The player is given game tips in some parts of the game, which is given as brief information at each point during the game to raise the player"s level of understanding. It can correspond to the cascading information as game mechanic and guidance as learning mechanic (see Figure 2.6, 2.10) (Lim et al., 2013). In Figure 3.13, the player gets a tip to check the profile of NPCs (see Figure 3.17) in order to obtain more information about the characters in the game.

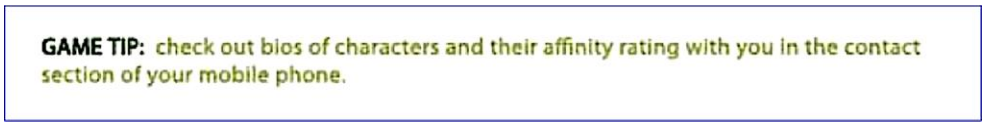

Figure 3.13: Game Tip Example

This player's in-game mood (mood meter; see section 3.2.4.2) is affected by doing activities. A game tip is shown (see Figure 3.14) to instruct the player how to change his/her mood by performing simple activities that are integrated into the game. Then, the player has the opportunity to boost positive feelings such as happiness, relaxation by doing simple activities. They are not part of the story and can be performed anytime during the game play by the player such as watching TV, doing homework, reading a book, sleeping, or eating. For instance, doing homework is illustrated in Figure 3.15 that causes an increase in confidence (by four points) while causing a decrease in energetic feeling (by four points) in the mood meter. The players learn to perform simple and effective strategies in order to improve their positive moods.

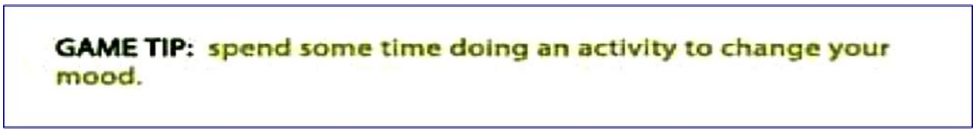

Figure 3.14: Game Tip Example

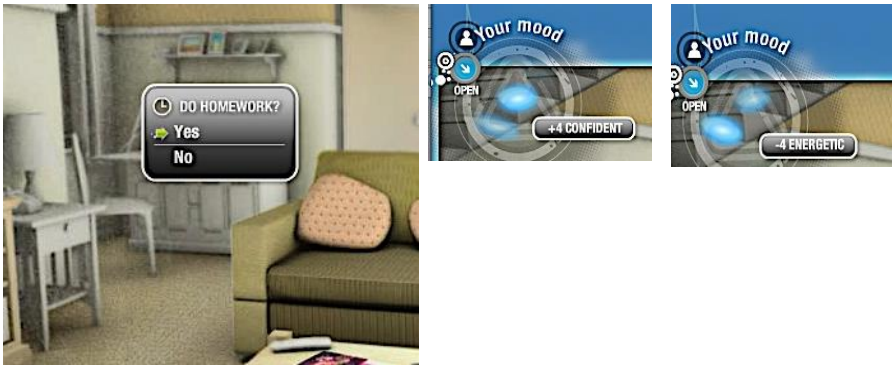

Figure 3.15: Doing Homework Activity- Mood Meter

The player is also shown a popup window at the end of each plot called "Link" to provide extra guidance and more information and a link to the fact sheet on the "Reach Out Central"[13] website that might be relevant or useful in the game play as shown in Figure 3.16.

[13] http://au.reachout.com

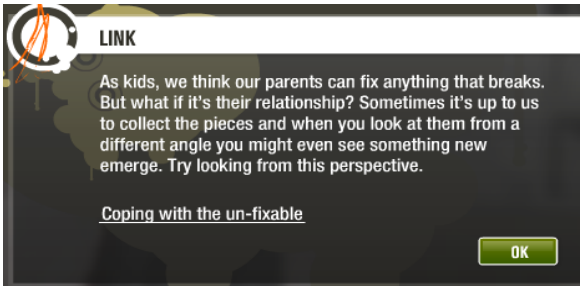

Figure 3.16: Link

3.3.2.3 Back-Story

In ROC, the back-story is a predefined story that introduces NPCs through storytelling and allows the player to gain more information. So, it is not part of the game and can be considered as an understanding layer for the player and correspond to the cut scene/story game mechanic (see section 2.3.1.1.1). In the ROC game, all non-player characters (NPCs) have a profile (short backstory), which is visible through the mobile phone. In this way, the player would be capable to get more information about the character‟s personality in order to be able to communicate nicely with them.

Figure 3.17 indicates Mum‟s back-story, which gives the player a general overview of mum‟s personality and her problems.

Figure 3.17: Mum's Backstory

3.3.3 Self-Regulation

Self-regulation of behavior is the process in which people use their own thoughts and actions to reach the goal. Self-regulated learners identify goals and then adopt and maintain their own strategies for reaching the goals (Bandura, 1986). Self-regulatory skill can be enhanced through goal setting, problem solving, and review of the progress to goal attainment (Thompson, 2010)(Thompson et al., 2007).

An important strategy in self-regulation is self-monitoring (Jane Lyons & Hatkevich, 2013). It means that individuals should be able to evaluate their own performances toward the goal. For instance, if one intends to lose weight, the self-monitoring of caloric intake, physical activity, and weight are among the strongest predictors of weight loss (Jane Lyons & Hatkevich, 2013). Goal-setting provides a way for self-monitoring and feedback, which are specific to a certain goal (Jane Lyons & Hatkevich, 2013). For example, to boost the self-regulation skill in **fitness** video games, the players are permitted to set workout **goals** for themselves. Then, the players should **schedule** workout days in advance, which can be done either manually or as a part of a premade program. A **workout calendar** is also used to indicate a history of game play, and sometimes upcoming scheduled workouts. The player‟s progress is shown in chart form as a **comparison** to past activities (Jane Lyons & Hatkevich, 2013). Another example of self-regulation is diet behavior change games such as Escape from Diab. As we mentioned in Chapter 2, section 2.4.1.4 , in the Escape from Diab video game, players set their own goals (i.e., drink 5 glasses of water daily), then possible problems and solutions are given to choose the one they expect more to achieve their goals. If they fail to achieve the goal, another chances are given to try other possible solutions. This stage is called „goal review‟.

We could only discover an example of self-regulation in two domains of health behavior change games including physical and diet areas. Since ROC (mental health domain) is not placed in this category, then we are not assured the self-regulation can be applied to this kind of games. In ROC, the player is not given the chance to opt his or her own goals. Goals are shown to the player sequentially from the game (game based goals). Besides, there is no a certain level for problem solving phase and goal review as Escape

from Diab video game and other diet change games such as Squre Quest, Boy Scout and so on. In these games, the players are given possible barriers they anticipate they may meet to achieve the goal, possible solutions, and evaluative feedback (see Fig 2.20)

In the following parts, we will discuss about game based goals and problem solving skill that we could find in ROC. However, we are not certain whether they are associated with self-regulation skill or not.

3.3.3.1 Game-Based Goals

In the ROC game, objectives (**what** an individual should try to accomplish) are shown to the players specifically and successively. They can help the players to concentrate on specific goals (tasks) in the context of the story, which keeps motivating them to continue the game in order to achieve the sub goals successfully. Hence, every completed goal can raise the player‟s self-efficacy. For example, the player is given sub goals to explore home, start chatting with strangers (see Figure 3.18), then looking for Maria‟s stolen purse and so on. The positive evaluative feedback will appear to the player after having accomplished the objective successfully.

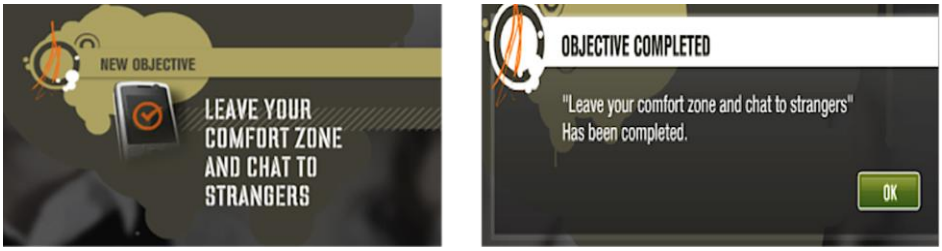

Figure 3.18: Game based Goals- Evaluative Feedback

3.3.3.2 Problem Solving

The key idea of the problem-solving phase is to create a challenge for the player in order to avoid reaching the goal too quickly. Knowledge and thinking skill (reasoning strategies) are essential factors for cognitive problem solving (Keith S. Dobson, 2010).

In ROC, the player‟s progress (the main and general goal) during the game is based on the friendship points that he/she can collect with other NPCs (see section 3.2.4.3) by answering or selecting the best option among several ones. So, when a new situation or scenario (i.e., support a friend who is being teased by other friends) occurs for the player, he should select one option that supports either the desired or unpleasant behavior that will result to increase or decrease the friendship rating.

In all scenarios, problem or event is identified for the player through the dialogue with other characters. For instance, when mum informs the player about her decision on the trial separation. Then, the player receives multiple options to choose the one that supports either rational thinking or cognitive distortions (negative thought) (see Figure 3.19)

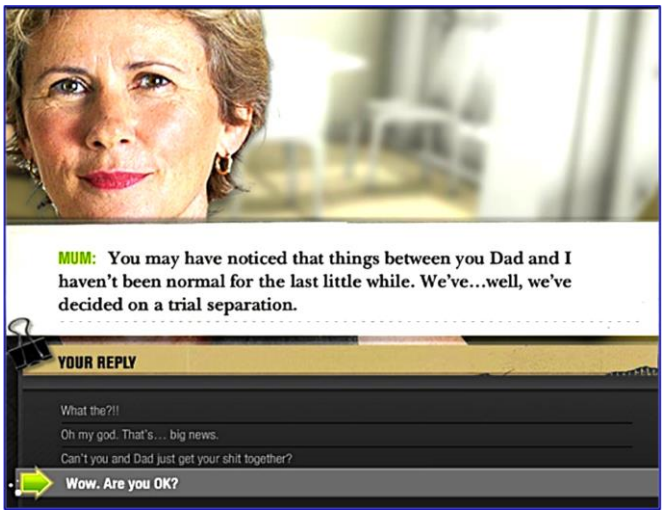

Figure 3.19: Example conversation between the player and his mum

In the next step, the player receives calls from the Paul to obtain more information and knowledge regarding to parental divorce situation (see Figure 3.20). This is just as a sample conversation between Paul and the player.

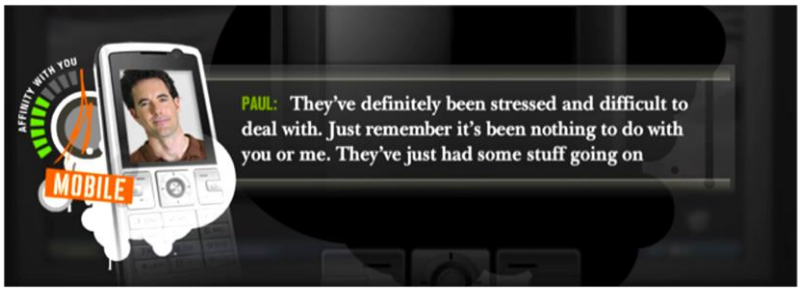

Figure 3.20: Paul's guidance (parental divorce situation)

Then the player is given another dialogue to communicate with his mum based on the information and knowledge he obtained from Paul. In this case, the player is scored on friendship rating with his mum depending on his answer (see Figure 3.21). For instance, in this dialogue mum is apologizing the player since she could not behave well with the player because of her divorce. Hence, the first option indicates the unpleasant behavior from the player (i.e., the bad tempered- that‟s an understatement), while the third one shows more desired behavior (i.e., I would‟ve been more supportive If I‟d know. I‟m sorry).

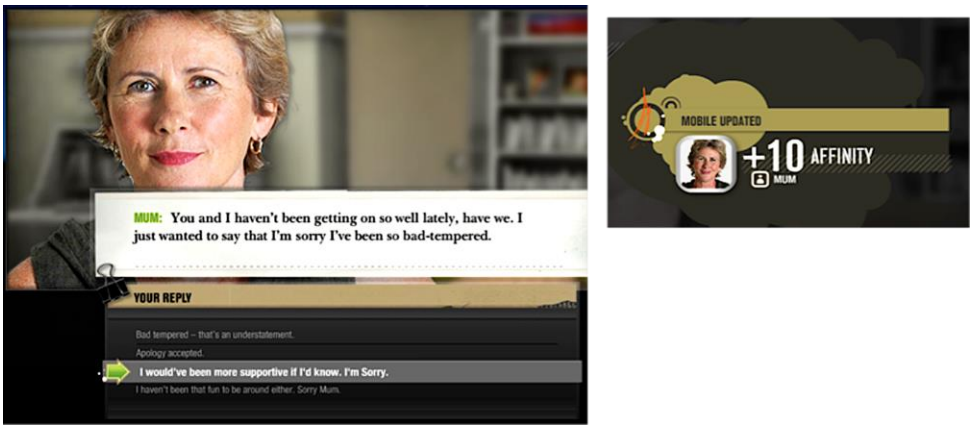

Figure 3.21: The player's answer- the corresponding feedback (increased friendship point)

What we could discover about goal setting and problem solving in this game is that ROC specifies a set of goals (i.e., chat with strangers, mum‟s divorce) for the player in order to be accomplished successfully. But the main goal is to increase the friendship points with NPCs under a certain goal. In other words, if the player could not be able to increase his friendship rating with other NPCs, then he will not receive new game based goals and subsequently cannot make the progress in the game.

For this purpose, the player should learn how to communicate well (can be considered as a problem solving skill) with other NPCs in order to achieve the goal.

3.4 Summary

This chapter presented the analysis of the ROC game to figure out how the Cognitive Behavior Theory and Social Cognitive Theory as a (pedagogical theories) have been applied in the game.

ROC is an adventure, role-playing and story based game that provides the virtual environment for the players to explore the relationship between their thoughts, feelings and behavior when they deal with challenging and tough situations.

CBT and SCT are the combination of behavior and cognitive theories (see section 2.2.3). Therefore, from the behavior perspective, modeling and feedback can be used in order to help the players to learn skill. Modeling and various types of feedback were discussed (see section 3.2.3 and 3.2.4).

In ROC, players can learn how their thoughts affect their feelings and behaviors in a certain situation, which is the basic principle of CBT. The cognitive restructuring technique was discovered in ROC regarding to CBT in order to instruct the players to evaluate their negative or realistic thoughts based on various feedbacks they could receive from the game. The mood meter is an essential tool in ROC to demonstrate the level of the player‟s feelings (both negative and positive) at particular situation.

Besides of reinforcement and modeling, several core concepts are considered in SCT such as self-efficacy, self-regulation and knowledge (Baranowski et al., 2008)(Thompson

et al., 2007)(Bandura, 1986). Enhanced self-efficacy is a function of SCT in doing the new behavior. ROC is not a game that has been designed to enhance the player‟s self-efficacy, but we could figure out a number of gaming mechanics that help the game players to raise their self-confidence during the game play. For instance, Paul as a trainer or model (see section 3.2.3) provides the good source of information to the player. This increases the player‟s level of knowledge and consequently his self-efficacy to perform new behavior. Besides modeling, the game based goals (see section 3.3.3.1) and different feedbacks (i.e., encouraging statements from ROC narrator, increased friendship rating, rewards) can boost the player‟s self-efficacy.

Acquisition of knowledge is another factor in SCT for behavior change. In this game, it is mainly achieved through the role model named Paul (see section 3.3.2.1), links, game tips (see section 3.3.2.2), and back-story (see section 3.3.2.3).

Self-regulation is another important skill in SCT. We could only discover an example of self-regulation in two domains of health behavior change games including physical and diet areas. ROC (mental health domain) is not placed in this category and we could not see the self-regulation activities in this game. However, goal-based games and problem-solving skill were discussed as sub parts of self-regulation, but we are not assured the self-regulation can be enhanced with them.

Chapter 4

Modeling a ROC Video Game Scenario with ATTAC-L

In this Chapter, we will first show the main principles of the ATTAC-L language that will be used to express the story part of ROC. The ATTAC-L modeling tool[14] is used to model the story part of the ROC game. Next, we will elaborate to model the pedagogical aspects of ROC with respect to CBT (cognitive restructuring) and SCT (self-efficacy).

4.1 Language Description

In this section, we discuss the main principles of ATTAC-L (Van Broeckhoven, 2013) that are used to model the story part of the ROC game. Briefly, ATTAC-L is a visual modeling language that enables modelers to express the story of a game as intuitive as possible in an abstract way. For this purpose, the combination of flow charts and natural language is used. The follow chart representation defines the chronological or hierarchical order between game moves, while the natural language like syntax will be used to express the individual game moves in the game (Van Broeckhoven, 2013). A game move can be an action to be performed by the player or NPCs (Van Broeckhoven & De Troyer, 2014). The general structure of ATTAC-L is composed of three main parts including the story flow, the definition part, and a scenario part as illustrated in Figure 4.1. The story flow and a scenario can be defined optionally. The story flow is the

[14] https://wise.vub.ac.be/attac-l/

sequence of game moves (actions) and the definition part specifies the definition of all objects that are not predefined by means of ATTAC-L and a scenario describes a part of the story flow, which can be defined inside of the main story or within another scenario.

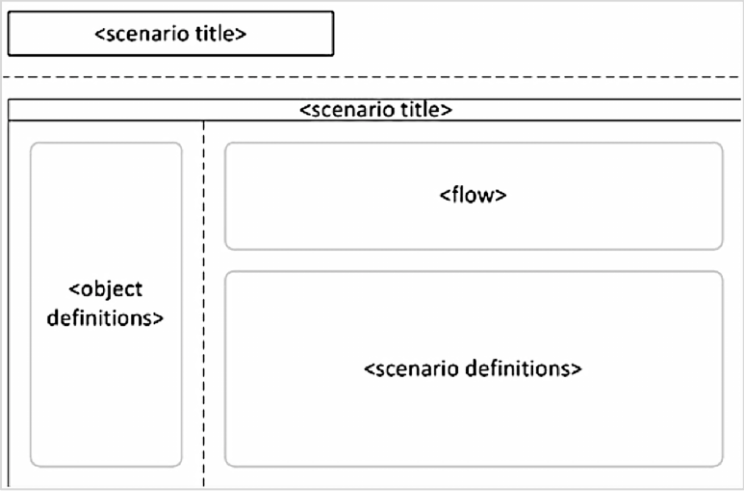

Figure 4.1: Story/ Scenario (Van Broeckhoven, 2013)

The language uses sentences following a strict syntax including a subject, a verb, and passive or indirect object to specify a game move. The game moves are constructed using bricks. Bricks are the small building blocks that used to model the individual actions within the story, the control structures, as well as for defining the characters in the story(Van Broeckhoven, 2013). They can be categorized into objects, verbs, and adverbs. Objects indicate the player, a non-playable character (NPC) or any tangible game entity and normally should be defined before they can be used in a game move (Van Broeckhoven, 2013). They belong to classes that are either predefined in the language or can be defined by the modeler. For instance, in ROC the player can be defined in the definition part briefly before it can be used in the story flow (see Figure 4.2). In this example, person and mood are specified as object classes that have several attributes. Player is defined very short with respect to ROC. He/she is a person, has mood (feeling), knows Chris (NPC), and has a mother (NPC).

A verb identifies the action that a subject performs in a game move. For instance, the player moves to a city, „moves to" is defined as a verb, which follows a player (subject) and one object (city). Adverbs are another type of bricks in order to represent states. For example, in this sentence „Juli is sad", sad is an adverb that is always come after a verb.

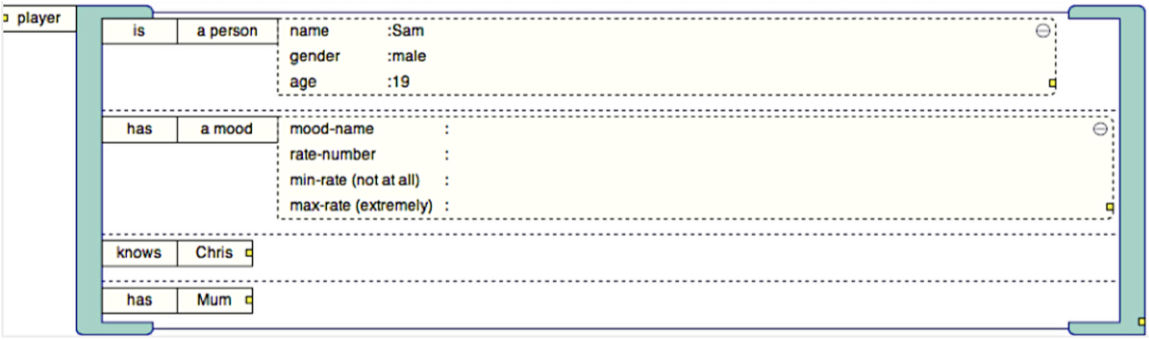

Figure 4.2: Player definition in ROC

4.1.1 Object Alias Definition

In ATTAC-L, the modeler can define an alias for an object or for a group of objects (Van Broeckhoven, 2013). For example, „Stranger" or „Friend" can be defined in the definition part as below (see Figure 4.3 and 4.4). Friend and stranger will be used in Figure 4.21.

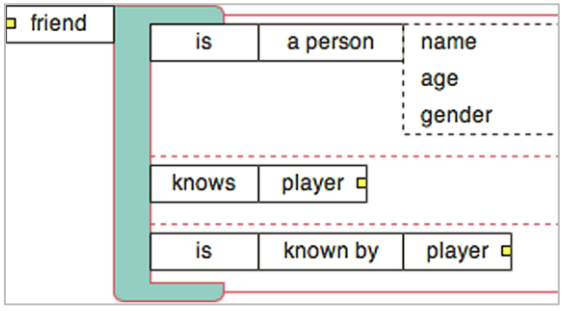

Figure 4.3: An example of object ailas definition in ROC (friend)

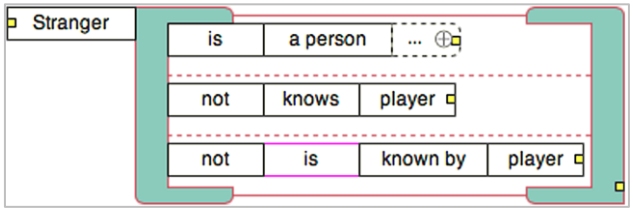

Figure 4.4: An example of object ailas definition in ROC (Stranger)

4.1.2 Control Structures

Control structures allow combining game moves and are used to specify the hierarchical order of the game moves in the story flow. ATTAC-L defines four types of control structures as follows (Van Broeckhoven, 2013) : A sequence brick connects exactly two game moves or storylines and specifies a sequential order between them. A choice control defines two or more game moves or storylines where a choice has to be made for which game move or storyline to track. An example of sequence and choice is shown in Figure 4.5. This indicates a part of parental divorce scenario, where the player is informed about the decision of his parents for trial separation. In this example, the player first talks to his/her mother, then (sequence brick) player‟s dad (Dad) sends a message to the player, and then (sequence) the player either selects the first response or the second answer (choice). This scenario can correspond to Figure 3.19 of Chapter 3.

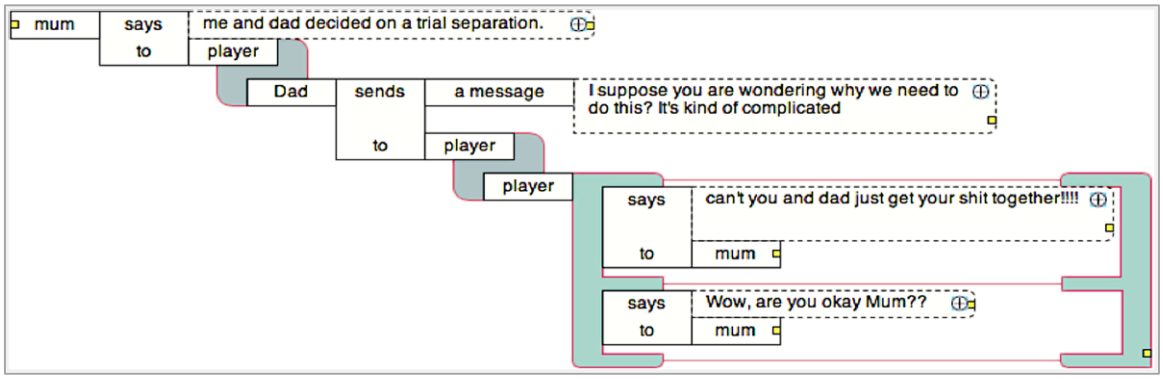

Figure 4.5: Example of Choice and Sequence Structure in ROC (a part of parental divorce scenario)

An Order independence control structure encloses two or more game moves or storylines that all have to be performed with in any order (Van Broeckhoven, 2013). In Figure 4.6, Juli is sad and talks to player. Both actions could be performed but the order is not important.

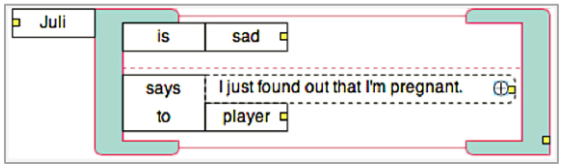

Figure 4.6: An Example of Order Independence in ROC

A Concurrency control structure is similar to the order independence control structure, but all storylines should be performed concurrently or at the same time. In Figure 4.7, when the player arrives at the party, he meets Juli, TJ, and Tim at the same time.

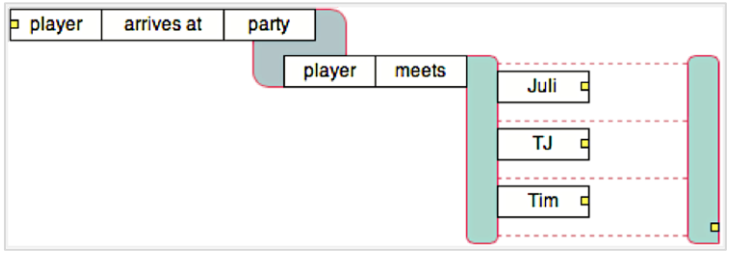

Figure 4.7: An Example of Concurrency in ROC

A Repeatedly brick expresses the repetition of a game move (Van Broeckhoven, 2013). The word „repeatedly" is located between the subject and the verb (see Figure 4.8). In this example, we use repeatedly brick to indicate Chris (NPC) laughs at Tim (NPC) regularly in order to make a joke of him.

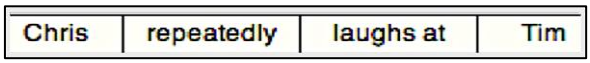

Figure 4.8: An Example of Repeatedly Brick in ROC

4.1.3 Scenarios: Hierarchical Decomposition of the Story

A scenario brick encapsulates a part of story in order to address with scalability and complexity (Van Broeckhoven, 2013). A name is defined that can be used to refer to a scenario. Figure 4.9 shows a scenario in which the player has to help Juli (NPC) to solve her problem. In this scenario, juli deals with an unexpected pregnancy from her boyfriend (Tim). They constantly fight with each other during the story. Therefore, she is pretty upset and informs the player about her pregnancy. So she expects the player to help and keep the secret. To model this part of ROC, we defined a scenario called „Juli‟s pregnancy‟. This scenario itself consists of three other scenarios as depicted in Figure 4.10, 4.11, and 4.12. In the first scenario, Juli (NPC) will inform the player about her pregnancy and ask the player to keep this secret (see Figure 4.10). In the second scenario, the player meets Juli‟s boyfriend (TJ) (see Figure 4.11), and the third scenario the player meets Juli again at the party (see Figure 4.12).

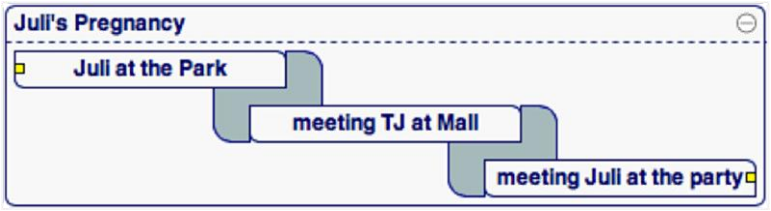

Figure 4.9: An Example of Scenario called Juli's Pregnancy in ROC

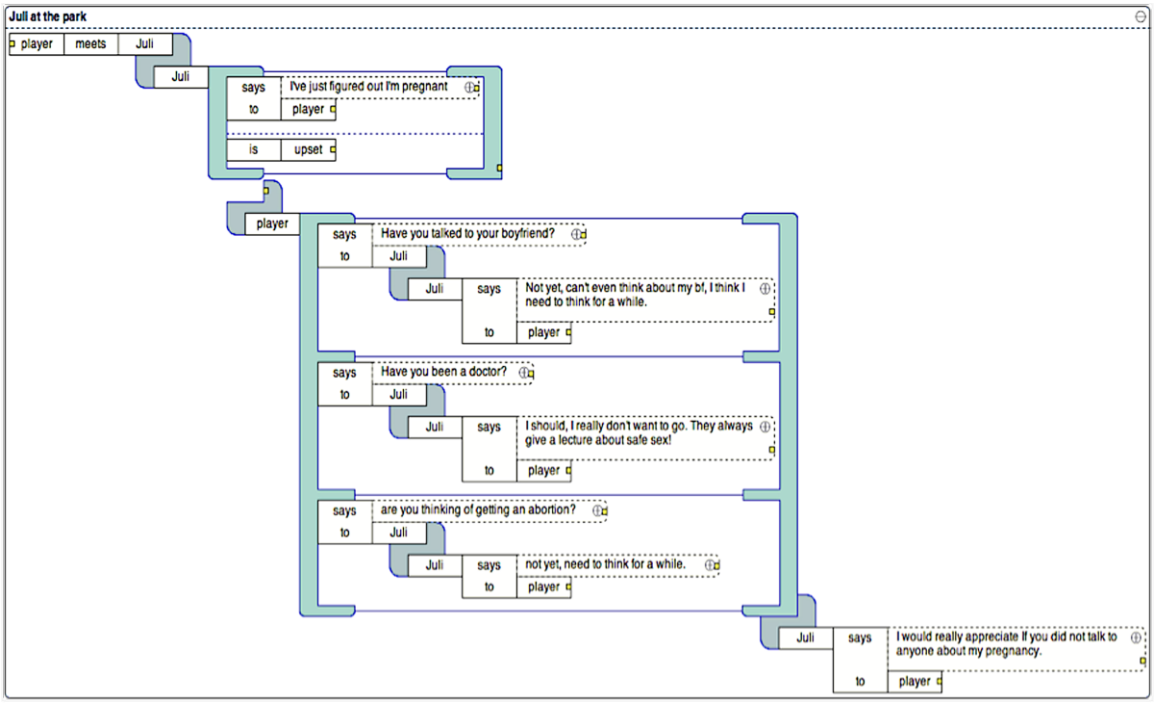

Figure 4.10: Juli at Park (sub scenario)

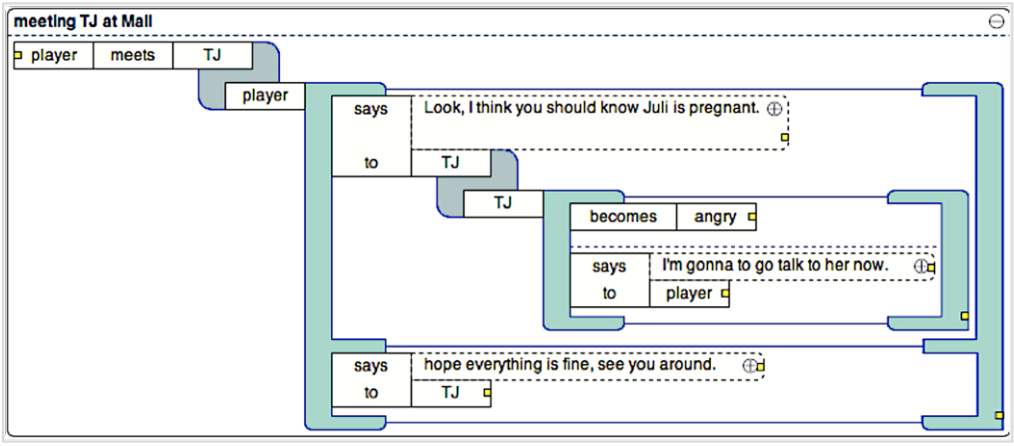

Figure 4.11: Meeting TJ at Mall (Sub Scenario)

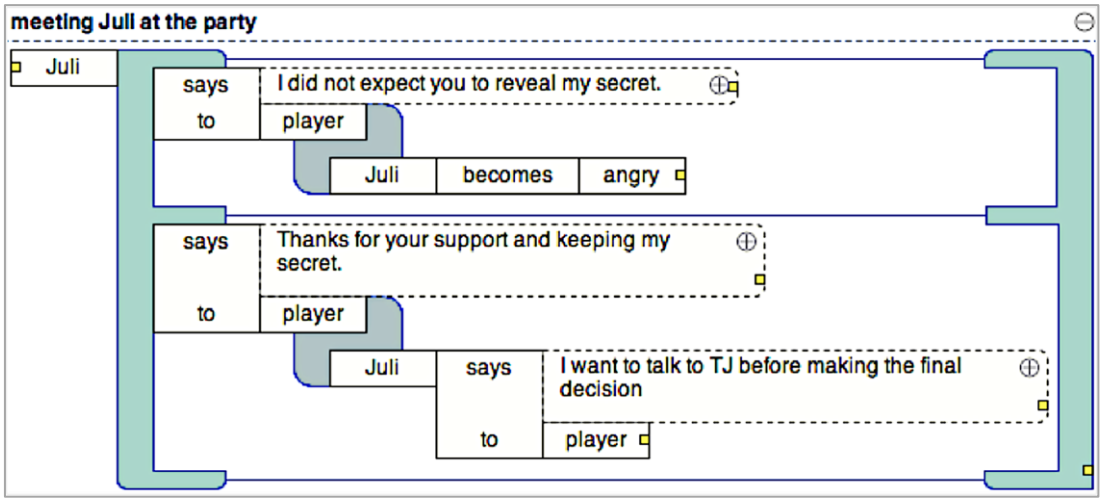

Figure 4.12: Meeting Juli at the Party (Sub Scenario)

4.1.4 Modeling the Pedagogical Aspects: Annotations

Annotations have been proposed in ATTAC-L to support the modeler to define the pedagogical characteristics of the learning games on top of the storyline model. Therefore, a distinct bound between the story part and the educational aspects exists (Van Broeckhoven & De Troyer, 2014).

In order to model the learning aspects by means of annotations, one needs to specify extra contextual information at certain points in the storyline (Van Broeckhoven & De Troyer, 2014). An annotation is represented as a small, square like brick, called annotation-brick containing a symbol, which indicates its function or purpose of the annotation. It has a set of properties-value pairs (called attributes). It can be attached to a game move or a scenario (Van Broeckhoven & De Troyer, 2014).

Annotations are categorized into either pedagogical objectives, or strategies, or pedagogical actions (Van Broeckhoven & De Troyer, 2014). Pedagogical objectives are

used to specify learning goals. A pedagogical strategy represents a set of methods to ensure a certain level of learning and is annotated to a scenario in order to define which strategy is used in the scenario. These annotations are still under development (Van Broeckhoven & De Troyer, 2014).

In order to satisfy the pedagogical objectives and strategies, adequately pedagogical actions and game mechanics should be provided. They might be used to give additional information or guidance to the player, assessment, and the opportunity for the player to repeat parts of the story and changing roles, and etc. For example, the changing role annotation allows the player to experience a part of the story from another point of view. For instance, this annotation can support intervention strategy, which is used for pedagogical objectives such as behavioral change (Van Broeckhoven & De Troyer, 2014).

The purpose of this part of the thesis is to define annotations that express the pedagogical aspects of the ROC game in more general way. The goal is to model the underlying learning purposes (i.e., self-efficacy, modeling, goal setting, feedback, and cognitive restructuring) and apply them on the ROC scenario.

In our modeling part, SCT can be introduced as a strategy annotation since several objective annotations such as self-efficacy, self-regulation, and knowledge can be defined to assure a certain degree of learning and behavior change in SCT. For example, model, game based goals and feedback can be defined as action annotations to achieve the self-efficacy objective annotation.

Cognitive restructuring is introduced as objective annotation that needs to be followed with several steps as below.

4.1.4.1 Cognitive Restructuring

Cognitive restructuring is a useful technique in CBT that focuses on how your thinking influences your feelings and behavior (D. Burns, 1989) (KENDALL, 2006) (see section 2.2.2.1). In this technique, people need to become aware of their atomic thoughts to approach situations in a more positive way.

To abstract this technique we define the cognitive reconstructing annotation  that can be attached to a scenario. The property „what" is a performance objective that can be given to the player (i.e., "Show your beliefs (thought) in ability to do something positive in dealing with break up situation") as shown in Figure 4.20. The six steps concerning to this method were discussed in section 2.2.2.1 . We will apply these steps on the break up scenario from ROC (see Chapter 3, section 3.2.2).

4.1.4.1.1 Situation

The inform annotation from the ATTAC-L language (Van Broeckhoven & De Troyer, 2014) can be used to inform the player in order to identify the upsetting situation (the first step; see section 2.2.2.1) that may cause the unpleasant and negative feelings. The inform annotation is used in ROC when the player needs to receive the extra **guidance** from the game. This can model the first step of restructuring technique, in which one should be able to identify the upsetting situation.

In ROC, the player receives a message from his partner that informs him about the breakup situation (see also Figure 3.1). Therefore, it is not probably necessary to use the inform annotation to inform the player again, but we use it in order to emphasize the importance of the situation to the player. The inform annotation is shown (i.e., Kate broke up with you. This really sucks) before Paul calls to the player (see Figure 4.13).

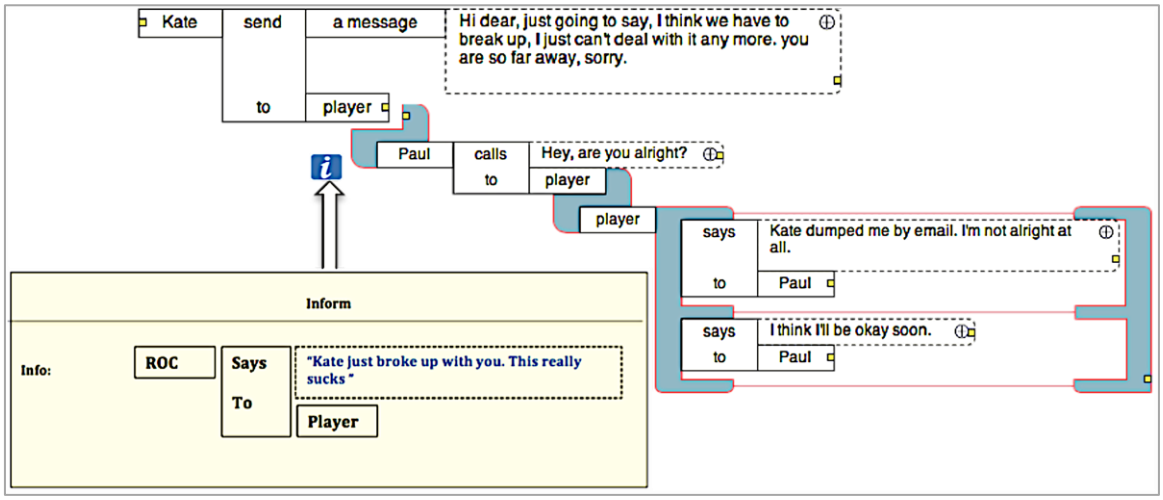

Figure 4.13: Inform annoation

4.1.4.1.2 Emotional Consequence Feedback

In ROC, the mood meter (see section 3.2.4.2) is a tool to give a feedback to the player about his feeling. Since the mood meter is specifically designed for ROC, we are going to generalize this tool for our learning purpose (cognitive restructuring) (see section 2.2.2.1 , step 2). At certain point of the story, an emotional consequence annotation (symbolized with red, yellow and, green) can be attached to a game move to show the player how he feels in a certain situation.

This annotation has an attribute "feedback". As we motioned, the player is defined in the definition part in which he/she has mood (see Figure 4.2) and a mood has several attributes (see Figure 4.14). Then, ROC shows a mood to the player. To support the modeler to be able to express the feeling word for the player, a „name" property is defined that can be set values (i.e., sad, happy, angry, and so on). It is also important for the modeler to specify the intensity of the feeling to the player. Hence, a „rate-number" property is introduced to facilitate the modeler to give rate from 1 (not at all) to 5 (extremely) for a certain mood at certain part of the story. Attributes „min-rate (not at all)" and „max-rate (extremely)" are introduced to define the scope of rating and give the meaning to the value of „rate-number", which means that the high value is 5 and the low value is 1. In ROC, mood tracker (see Figure 3.4) is demonstrated to the player when he

logs into the game in order to evaluate his feelings in real life situation while he is playing ROC. The mood tracker specifies the degree of the player‟s feeling using words (not at all =1, a little=2, moderately=3, quite a bit=4, and extremely=5). In this example, the modeler can show to the player that he is extremely sad (the annotation is symbolized with red face) by setting value of 5 as a rate-number. In Figure 4.15, two various emotional consequence feedbacks are indicated according to the player‟s answer in responding to the breakup situation. The annotation symbolized with yellow face can show the player is moderately sad (i.e., rate-number can be set to 3).

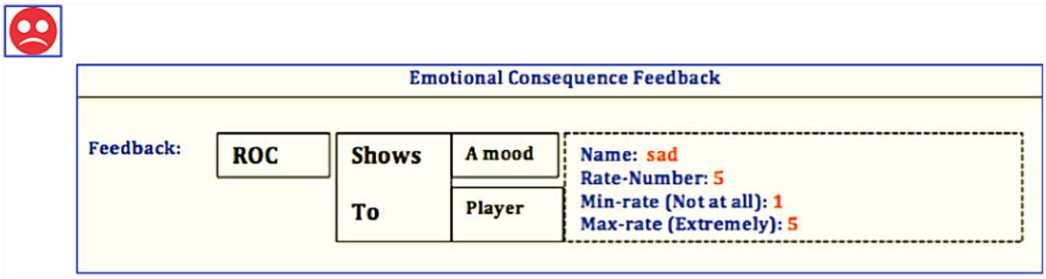

Figure 4.14: Emotional Consequence Feedback annotation

4.1.4.1.3 Negative Thought (Cognitive Distortion)

The negative thought (NT) annotation  indicates the NT (cognitive distortion) to the player. It can be used as **guidance** (extra information) next to the options. In ROC, the player is not given a guidance to recognize the options containing cognitive distortion before selecting them. However, we apply this annotation on ROC scenario to help the player to identify and analyze the possible negative thoughts before selecting his answer. It corresponds to the third and froth step of cognitive restructuring technique in section 2.2.2.1

For this purpose, the property „NT“ is introduced as shown in Figure 4.15. In this example, the third option contains two types of cognitive distortions. First, the player is labeling himself as a„loser“, and secondly he is blaming himself and personalizing the problem. Table 2 (see page 104) demonstrates the most common cognitive distortions (D.

Burns, 1989). The modeler can define more than one cognitive distortion (NT) by defining index next to each property. This scenario can correspond to Figure 3.2 from Chapter 3.

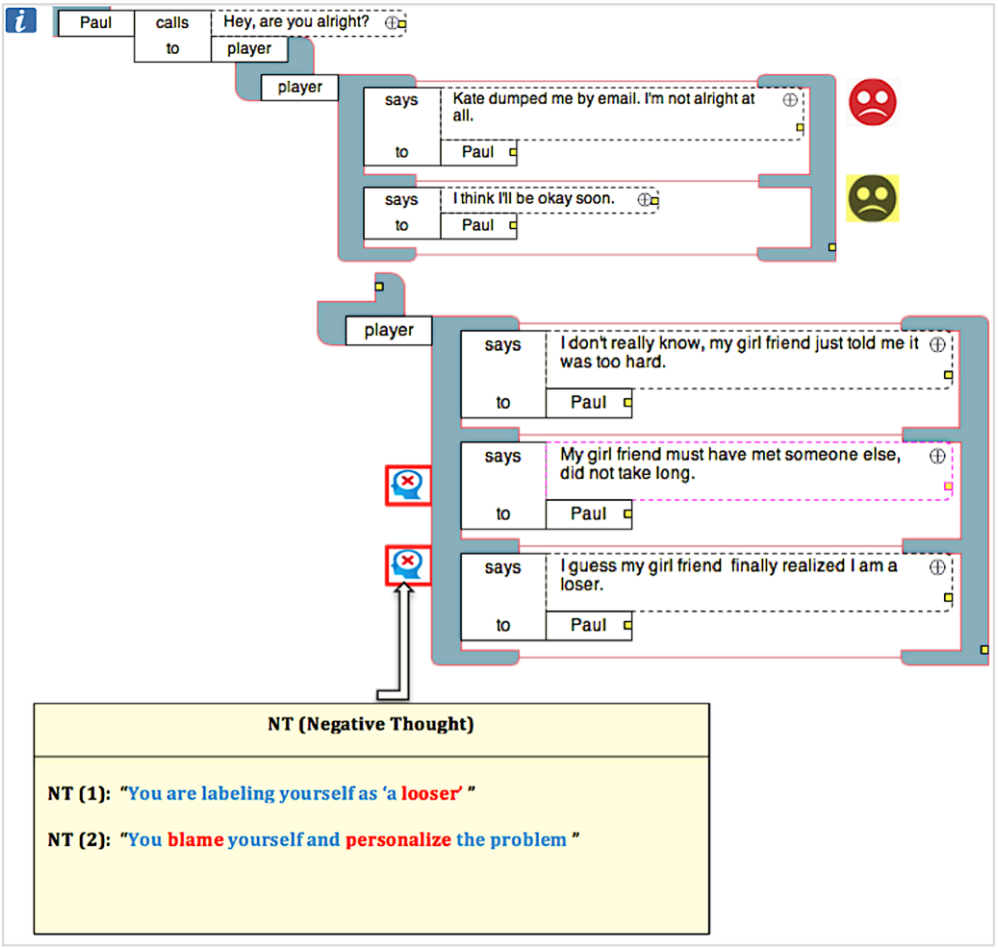

Figure 4.15: Negative Thought annotation

4.1.4.1.4 Untwist Thinking

In this phase, one should be able to construct more logical and balanced thought. In the ROC game, a feedback is shown to the player to help him to evaluate the truthfulness of his thoughts (i.e., asking challenging question).

Untwist thinking feedback annotation  is introduced to model the fifth step of this technique. To support the modeler to define which method he is using for untwisting thinking, the property „what method" is defined (see Table 3, Page 106) (D. Burns, 1989). The property „feedback" is a feedback that is shown to the player.

In this example (see Fig 4.18), in the second option, the player is jumping to the negative conclusion. Therefore, the player should ask himself, is there any evidence to support his thought in order to evaluate the truthfulness of his thoughts (see Fig 4.16).

The third option shows that the player is labeling himself as a loser (cognitive distortion, see section 3.2.2 . So the corresponding untwist thinking method is shown to the player as a feedback. The player should ask himself „what is the definition of loser?" see Figure 4.17). Hence, the player will feel better when he realizes that there is no such thing as „a loser" (D. Burns, 1989).

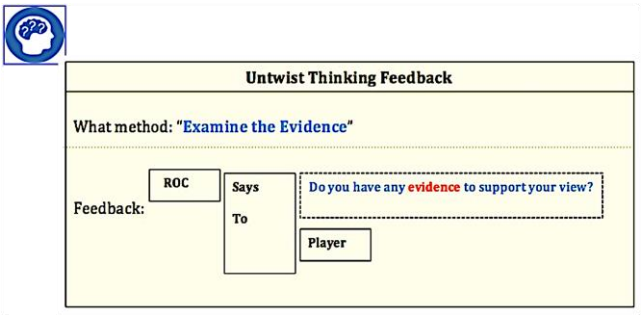

Figure 4.16: Untwist Thniking Feedback annotation

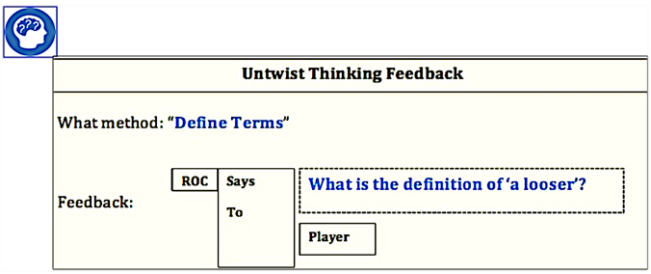

Figure 4.17: Untwist Thniking Feedback annotation

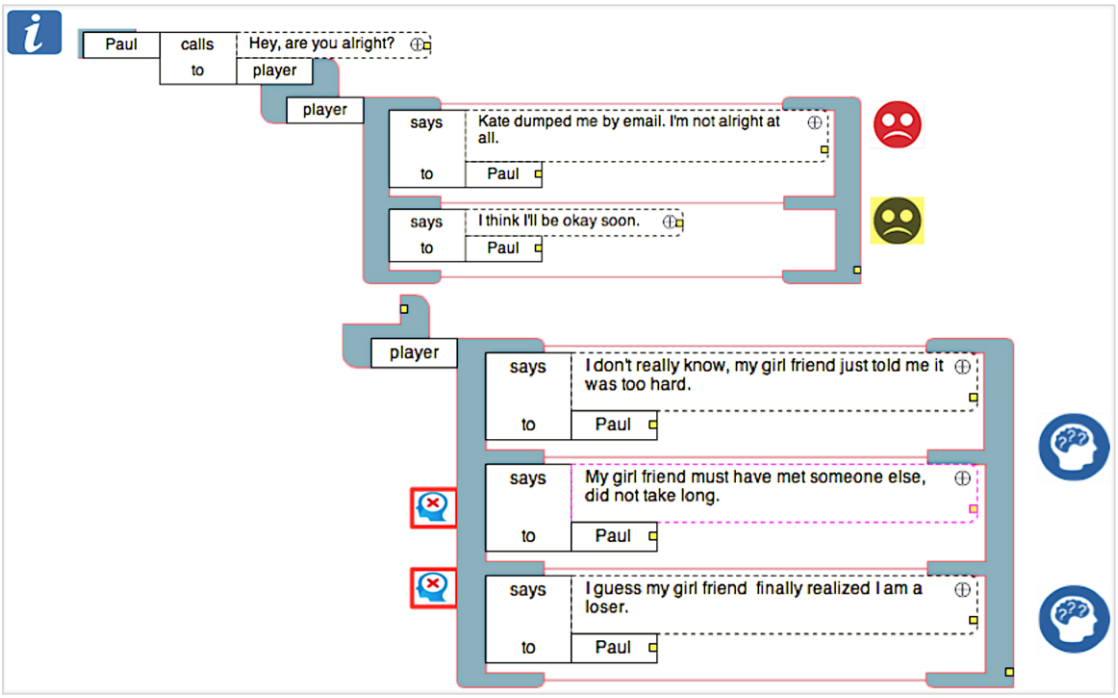

Figure 4.18: Example (untiwst thinking)

4.1.4.1.5 Evaluate the Restructuring Process

In this phase, the player‟s feeling should be evaluated again (see cognitive restructuring technique, step five in section 2.2.2.1). It specifies whether the player could achieve the learning goal of this scenario (i.e., Show your belief (thought) in ability to do something positive in dealing with break up situation). If the present mood is still not satisfied, the player can return to step 4 to analyze the negative thoughts again. Emotional consequences feedbacks are shown to the player to inform him about his feelings.

Evaluative feedback annotation is introduced to evaluate the player‟s performance to achieve the goal. This annotation can be almost similar to the checkpoint annotation in the ATTAC-L language (Van Broeckhoven, 2013).

This annotation  indicates a positive feedback to the player for his completed goal. A feedback attribute is defined to exhibit positive feedback to the player. For instance, the

player receives very encouraging feedback (i.e., your mood has changed in positive way, good job) when the player shows positive attitude in dealing with the break up situation (see Figure 4.20). Otherwise, this annotation will be presented if the player"s action is not satisfied. In this scenario, the player receives a feedback from ROC (i.e., your mood is still pretty sad. Try to analyze your negative thoughts again). A property „go back to" is defined to make a reference to a certain game move where the player should rehearse the portion from this annotation named "Paul calls the player". The whole scenario is presented in Figure 4.20.

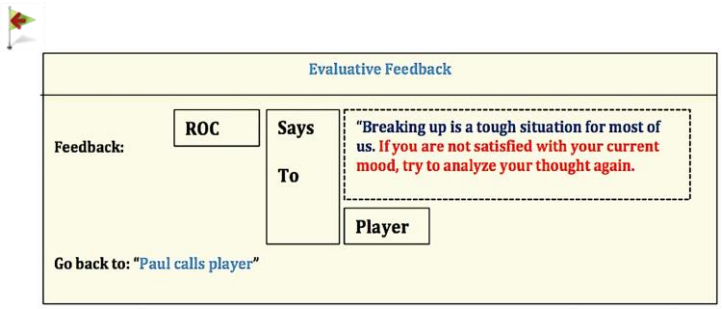

Figure 4.19: Evaluative Feedback Annotation

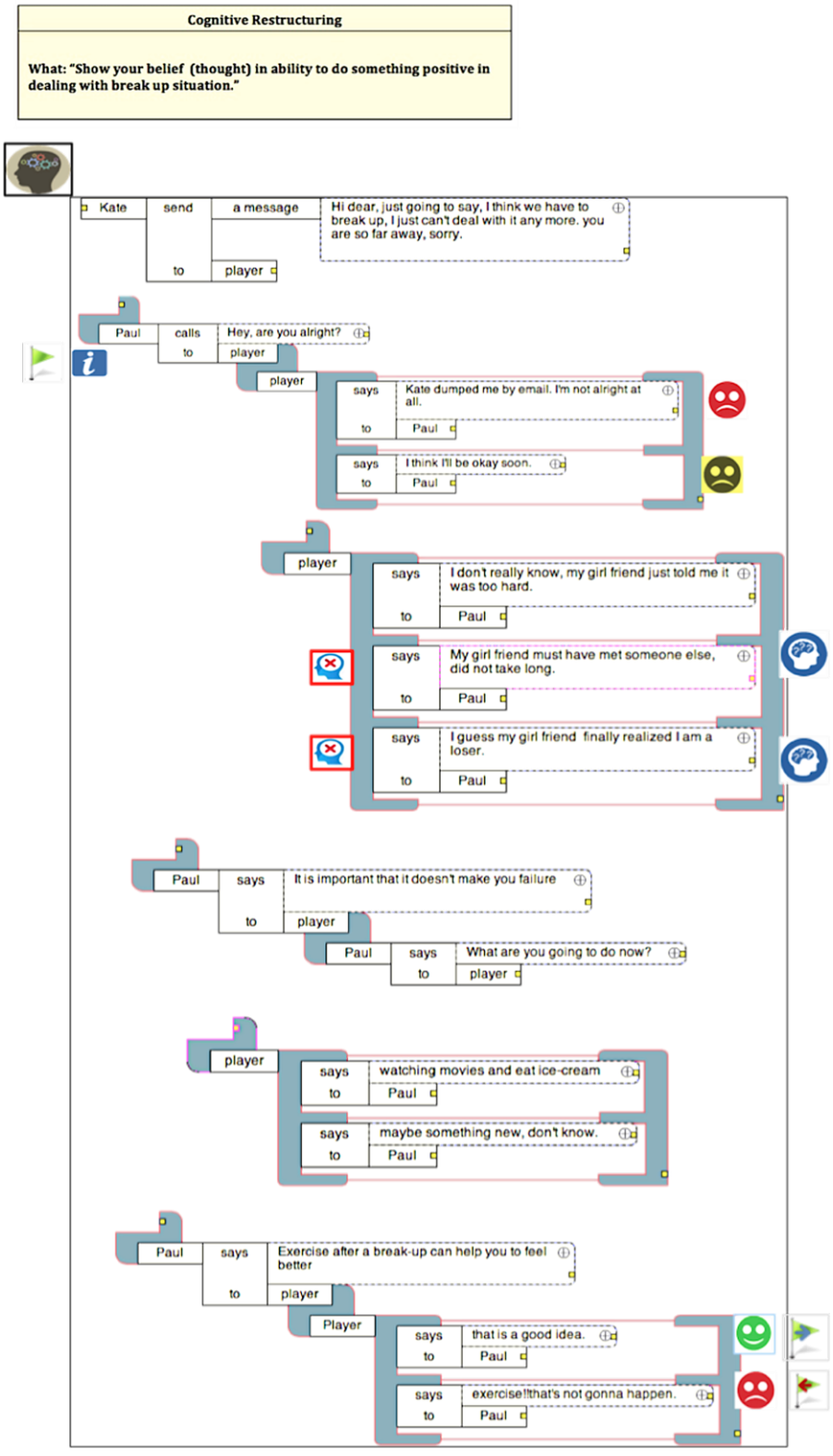

Figure 4.20: Example of Cognitive Restructring

4.1.4.2 Self-Efficacy

As we discussed in Chapter 2, section 2.2.1.4 , self-efficacy is an important factor that affects the learners to perform a task or the desired behavior successfully (Bandura, 1986). Model, goal setting, and feedback are important principles that have the influence on self-efficacy (Schunk, 1989).

In this section, an abstract scenario from ROC is selected to have different annotations applied, including modeling, useful feedback and goal setting.

The way the scenario is modeled here is not exactly similar as in ROC. It has been modified base on the information we could understand that assists the player to raise his/her self-efficacy during the game play.

The self-efficacy annotation  will be introduced to evaluate whether the player is confident to perform a task successfully for a certain scenario. It is attached to a scenario as shown in Figure 4.22.

Two attributes including „what" and „when normal /low/high" are defined. The property „what" defines the learning goal regarding to self-efficacy. For example, the player should be able to express confidence in the ability to socialize with new people successfully as shown in Figure 4.22.

The latter attribute specifies the degree of the player"s self-efficacy. Although it is not the accurate way to determine the degree of the player"s self-efficacy (low or high or normal), it can be useful for the modeler to identify in which part of the story, the player will have more or less self-efficacy (identified based on the player"s actions). The way the modeler designs the narrative part is essential to evaluate the degree of the player"s self-efficacy. For example, the modeler can design more options in the context of the story and depending on the player"s answer, he can evaluate whether the player has low or normal or high self-confidence.

In this example, the emotional consequence feedback can be used to show the player"s confidence (either low or normal or high) at certain points of the scenario. For instance, when the player accepts Chris"s invitation immediately or after several conversations or

when he is not convinced to accept the invitation at all. Therefore, every response of the player gives an indication of the different levels of self-efficacy of the player. As seen in Figure 4.23, the modeler can use the emotional consequence feedback (symbolized by a red face symbol) to show that the player may have a low confidence in socializing with new people. On the other hand, in response to the first option ("I really enjoy chatting") modeler can use the emotional consequence feedback (symbolized by a green face symbol) to show that the player may have a high confidence in this situation. Figure 4.24 illustrates the emotional consequence feedback when the player has a high self-efficacy, which corresponds to the green face symbol in Figure 4.23.

4.1.4.2.1 Modeling

Modeling (or observational learning) is the process of learning by observing others (models) to produce a behavior before doing it oneself. This can be considered as a therapeutic technique to produce behavioral change. Model is an important source of self-efficacy. Observing competent models successfully perform actions convey information to the observers (Schunk, 1995).

In the ROC game, Paul only describes his experiences and instructs the player in performing the desired behavior. So Paul does not show the behavior as models we illustrated in EA Sports Active 2 and Escape from Diab video games (see Figure 2.2). Paul mostly acts as a trainer or consoler (see section 3.2.3). Therefore, we modify the modeling part of ROC for which the model (Paul) shows the right behavior to the learner or player. In this example, the modeling part is encapsulated as a scenario that can be attached to a game move when it is required to appear to the player. In Figure 4.22, the scenario named „Model meets new people" is attached to a game move, where the player has to respond to the Chris"s invitation.

In this part, the player does not play the game and his/her role is being an observer in order to learn what to do to perform the right behavior from the model. Therefore, we define the modeling annotation  (almost similar to the non-playable annotation in ATTAC-L), which is placed at the beginning of specific game move to

show where player does not play. To specify the role of player an attribute „role“ is defined as illustrated in Figure 4.21. This annotation  is defined to show in which point of the story the player is no longer observer and can play. In this annotation, „feedback“ attribute is defined to raise the player“s self-efficacy by giving a persuasive and positive feedback (i.e., if the model can do, so you can). Model can also be defined in the definition part as exhibited in Figure 4.21. In this example, model is Paul who shows the behavior and relevant emotions when he deals with a challenging situation when he does not know anyone at the party, and looking for opportunities to find new friends (this scenario is shown very abstractly). Paul can be considered as a mastery model to show possible fears of observers but performs the desired behavior.

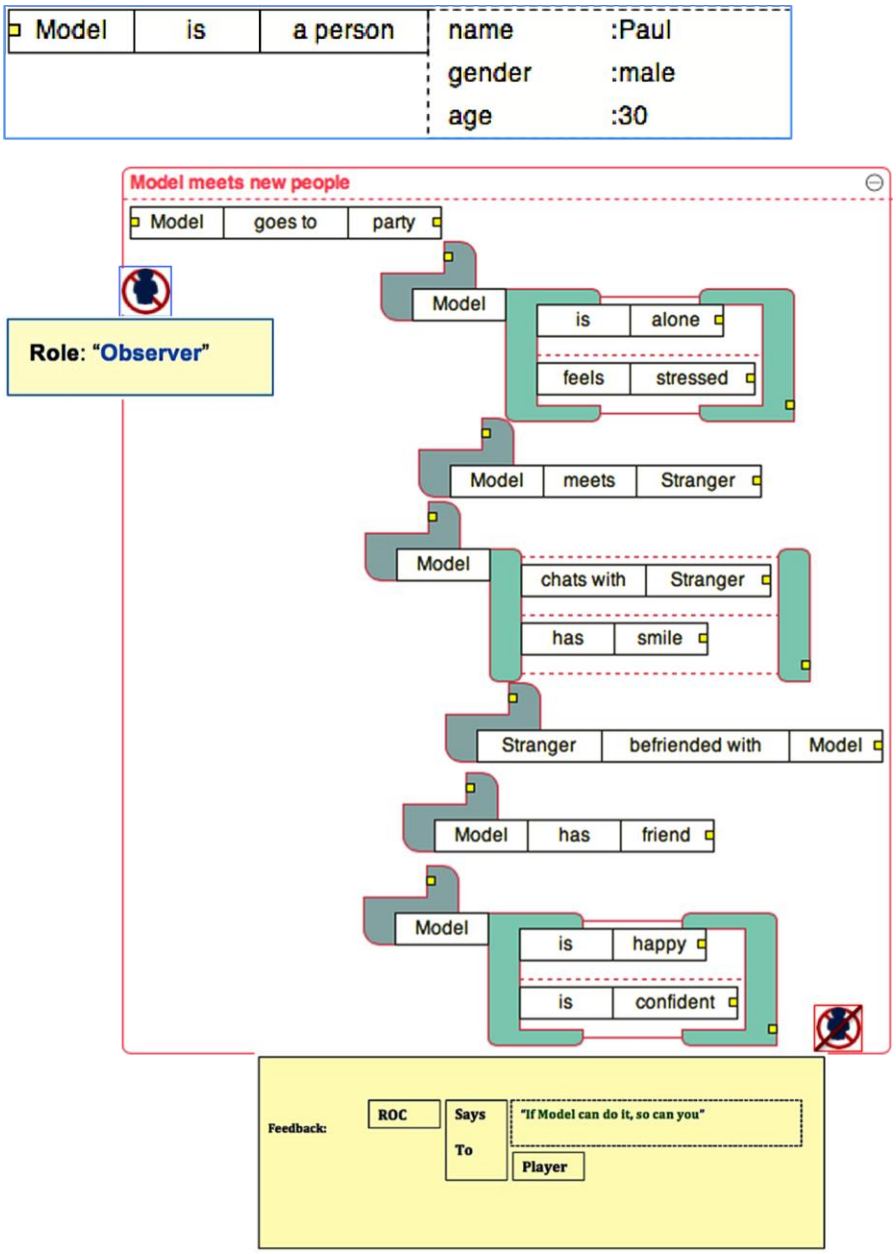

Figure 4.21: Scenario designed for Modeling Part- Model Defnition

4.1.4.2.2 Game based Goals/Objectives

Objectives or goals have the influence on behavior by means of their effects on cognitive and motivational mechanism. Goals motivate and engage individuals to use their efforts to meet task demands and may experience a sense of self-efficacy for achieving the goal (Schunk, 1987).

An important characteristic of ROC is to accomplish specific goals or objectives during the game.

To support game based goals in ROC, we have defined a goal annotation that allows annotating a game move to indicate that a goal should be given to the player. Game based goals in the ROC game illustrated in Figure 3.18. The property „goal" is defined to show a goal that the player should try to accomplish (i.e., "meet Chris"s friends at the party"). Feedback on goal progress raises self-efficacy and provides information about progress towards goals (Schunk, 1995). Therefore, the evaluative feedback annotation, which was introduced in section 4.1.4.1.5 , is used to evaluate the player"s performance towards the goal. In this scenario, the player receives a goal ("meet Chris" friends at the party"). If the player could socialize with new people successfully, then he will be given positive evaluative feedback (symbolized with green; see Fig 4.23) (i.e., you are good at socializing with strangers); otherwise, he will be given the evaluative feedback (symbolized with red; see Fig 4.23) to rehearse the goal again (i.e., "chatting with new people can be stressing situation. Do you want to try one more time?").

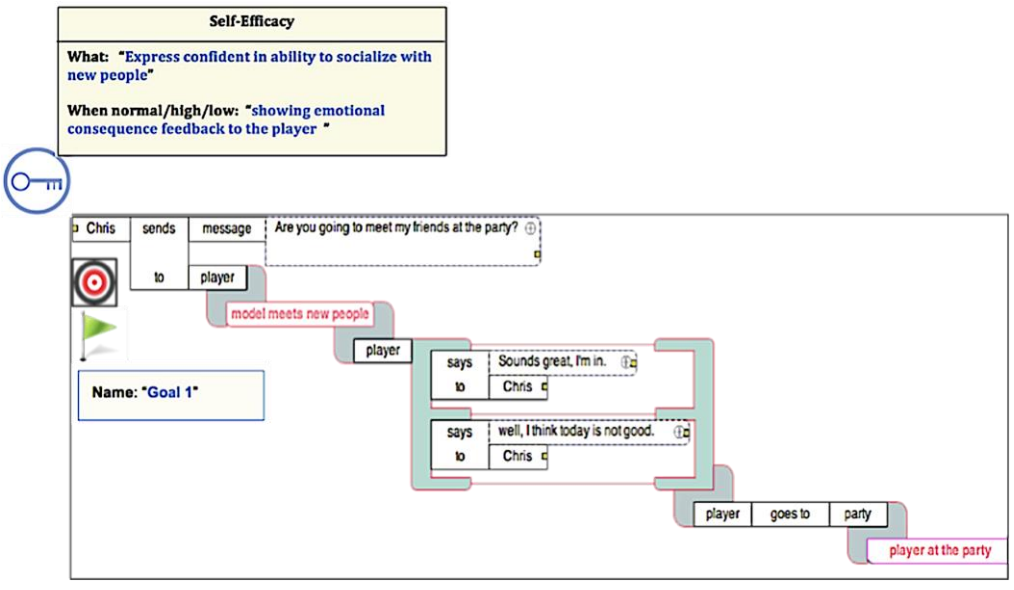

Figure 4.22: Self-Efficacy Example (see 4.23 sub senario of this example)

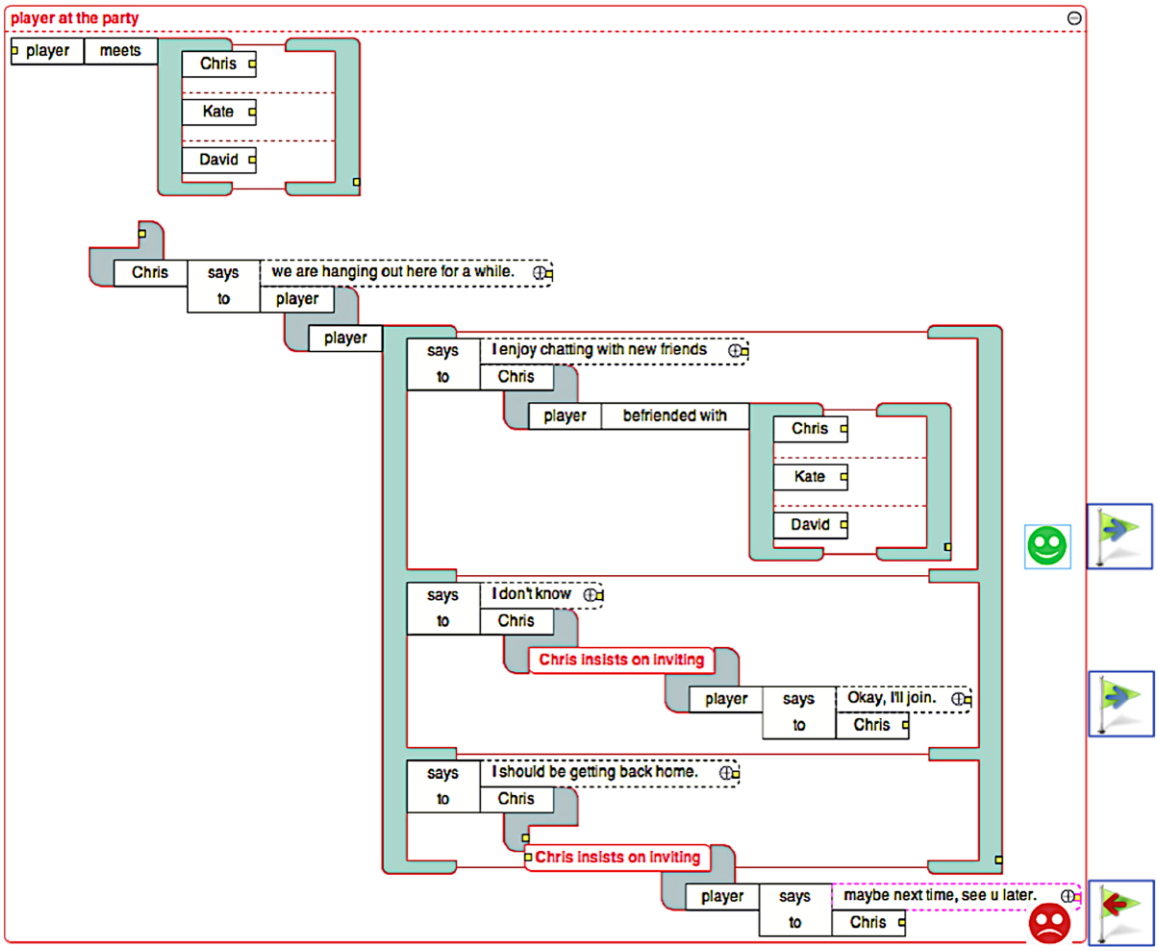

Figure 4.23: Player at the Party (Sub-Scenario of Figure 4.22)

In the above example, the player has to select the right option after observing a model (illustrated as a scenario called „model meets new people"), which is placed after a game move ("Chris sends a message to the player") (see Figure 4.22). The emotional consequence feedbacks are shown to the player at the end of the scenario to specify the degree of the player's self-efficacy. For example, the emotional consequence feedback (symbolized with green) shows the high level of self-efficacy to the player.

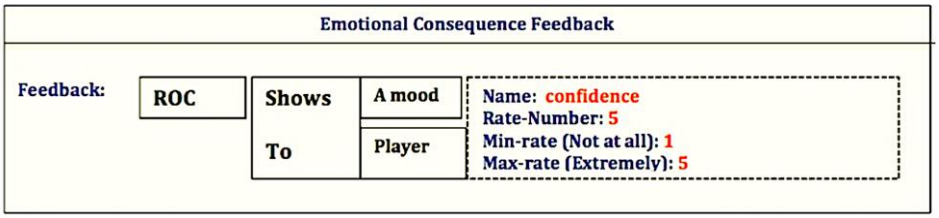

Figure 4.24: Emotional Consequence Feedback (high Self-Efficacy)

4.1.4.3 Score

The purpose of this part is to define a scoring system that supports ROC and it also should be generalized adequately to model other educational games. As we mentioned in Chapter 3, section 3.2.4.3 , the scoring system is the main evaluation and assessment of the player‟s progress in the ROC game in which the player is scored on the friendship with other characters. It is another type of feedback that is shown to inform the player about the consequence of his action. It is essential gaming mechanic for both SCT and CBT since it is an important feedback. It also follows action point systems and corresponds to assessment as the learning mechanic (see Figure 2.14).

This score annotation  is defined when the player‟s score is raised while the red one  is introduced for decreasing the score. A feedback property is defined since scoring system is another type of feedback. A score object is defined that has several attributes (see Figure 4.25). To support the modeler to which action the player gets scored, „on“ attribute is defined. In this example, the player is scored on friendship rating with Paul. Another example, in Re-Mission (see Figure 2.14), the player is scored on the number of cancerous cells that are killed in each level. An „increased by“ or „decreased by“ attribute is introduced to enable the modeler to indicate the amount with which the value should be decreased or increased for his/her action. The „current point“ is defined to determine the current score of the player. In Re-Mission, the player could be able to see the overall

score gained in each level. Therefore, it can be important for the modeler to indicate the current point of the player at different part of the story to the player.

Attributes „min“ and „max“ are introduced to define the scope of rating and to give the meaning to the value of „current point“. In ROC, the high level of friendship rating that can be defined to the player is 50, while the minimum value is zero. In this example, the player gets scored on friendship rating with Paul depending on his answer.

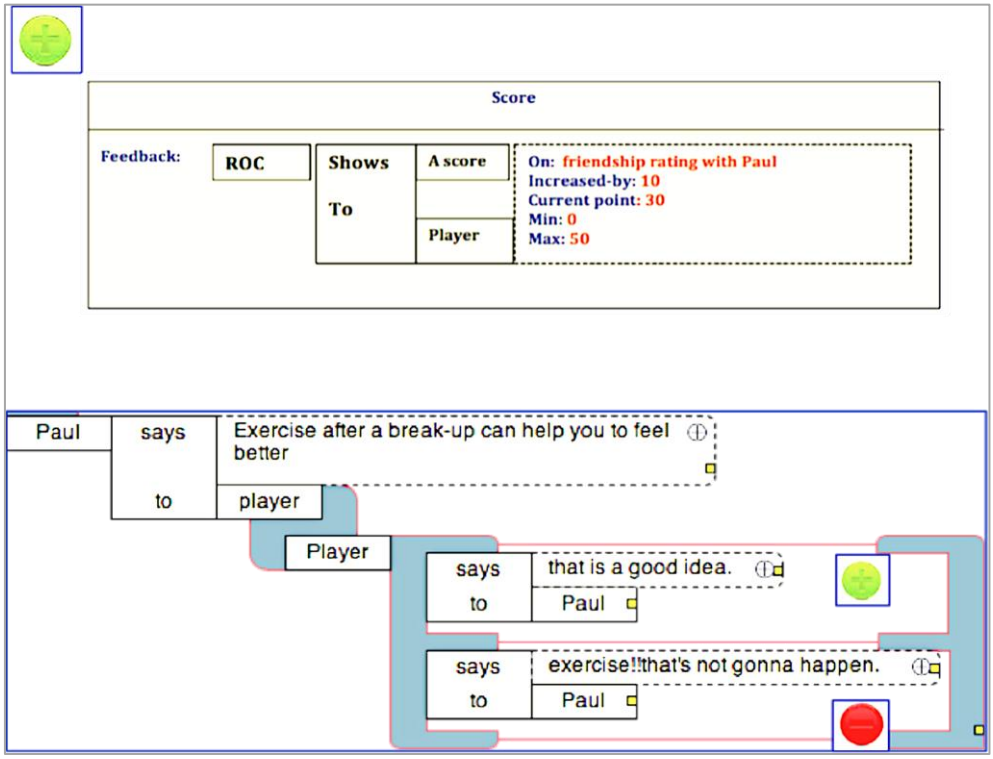

Figure 4.25: Scoring System

4.1.4.4 Inform

The inform annotation can be used to inject the extra guidance as we demonstrated in section 4.1.4.1.1 . Other game mechanics that increase the player“s level of knowledge such as game tips (see Figure 3.13) and link (see Figure 3.16) can also be modeled by means of the inform annotation

4.1.5 Classification of Annotations

Cognitive Restructuring:	
Inform:	
Emotional Consequence Feedback:	  
Negative Thought (NT)	
Untwist Thinking Feedback:	
Evaluative Feedback:	  
Self-Efficacy:	
Modeling:	 
Goal-setting:	
Score:	 

Table 4-1: Classification of Annotations

4.2 Limitations

Several limitations can be mentioned here regarding to this chapter. We could only discover an example of self-regulation in two domains of health behavior change games including physical and diet areas. However, none of them were available to play. Therefore, we did not access to a scenario in order to exactly understand how self-regulation can be mapped into video games in context of the story. As a result, we could not find a way to model the self-regulation as an objective annotation.

ROC is basically designed from CBT perspective to show the relationship between thought, feeling and behavior. In my view, it is not a game that particularly designed for SCT. Although we could discover the importance of self-efficacy, model and knowledge (important factors in SCT), but the self-regulatory activities could not be recognized obviously.

We could figure out a number of gaming mechanics that help the game players to raise their self-confidence in ROC (see section 4.1.4.2). However, we believe that the accurate GM-LM model (similar too Figure 2.6) could be advantageous to exactly indicate what gaming mechanics can be applied to achieve SCT or other objectives such as self-efficacy. For example, if we were able to find a publication regarding to ROC that shows obviously what gaming mechanics can raise the self-efficacy then we would be capable of modeling the self-efficacy more accurately.

The whole scenario of ROC is depending on multiple questions and answers between the player and NPCs. Hence; it was not very challenging to model the story part of this game by ATTAC-L. We could get help from the ATTAC-L tool to design the story part of ROC. Although we used scenarios (see section 4.1.3) to deal with the scalability and complexity of the model, it was not easy to model the detailed scenario in ATTAC-L and represent it in this work (the pictures are not very clear). Therefore, very abstract concepts have been modeled. Besides, the ATTAC-L tool doesn‟t support annotations yet which are still under development.

4.3 Summary

In this chapter, we first showed the main principles of the ATTAC-L language that used to express the story part of ROC. For this, several concepts including bricks, control structures, scenario bricks, the definitions, and object aliases were described with respect to the ROC scenario. In the next part of this chapter, we mainly focused to model the educational aspects of CBT (cognitive restructuring) and SCT. Cognitive restructuring technique is used in ROC to instruct the players to think more positively and rationally instead of thinking negatively in order to improve their feelings and behavior. Therefore, this technique was modeled depending on section 2.2.2.1 and 3.2.2 . Model, various kinds of feedbacks, game-based goals, and modeling, Self-efficacy are important behavior change factors in SCT that we could find in ROC. Besides, model, feedback and goal-setting are essential to affect self-efficacy. Self-efficacy as an objective annotation was introduced that can be attached to a scenario in order to evaluate the level of the player‟s self-efficacy. Model (see section 4.1.4.2.1 evaluative feedback annotation, game-based goals (see section 4.1.4.2.2), and emotional consequence feedback are defined in the context of a scenario associated with self-efficacy (see Figure 4.22, 4.23). Lastly, the score annotation was introduced to model the scoring system (see section 4.1.4.3).

Chapter 5

Related Work

In this chapter we discuss work, that was not discussed in Chapter 2, and which relates closely to ATTAC-L. We review work that is related to our goals, which is the story-modeling tool that aims toward more involvement of none-technical people in the adventure game development process.

5.1 <E-Adventure>

The <e-adventure> platform[15] is an educational game authoring tool that aims to design adventure games by non-technical people (people who do not have an in depth programming experience). It assists the progress of the integration of games in the learning process. As such, its purpose is closely related to the purpose of ATTAC-L. This platform allows domain experts to develop their own educational games and facilitate them to examine the accuracy of knowledge in the game by means of two strategies (Torrente, del Blanco, Marchiori, Moreno-Ger, & Fernández-Manjón, 2010).

First, the authoring tool allows the instructors or domain experts to create their own games without requiring a deep technical background. A screenshot of the tool is provided in Figure 5.1. People can create characters for the game by importing photos of the characters, conversations, and cut scenes (Torrente et al., 2010).

[15] http://e-adventure.e-ucm.es

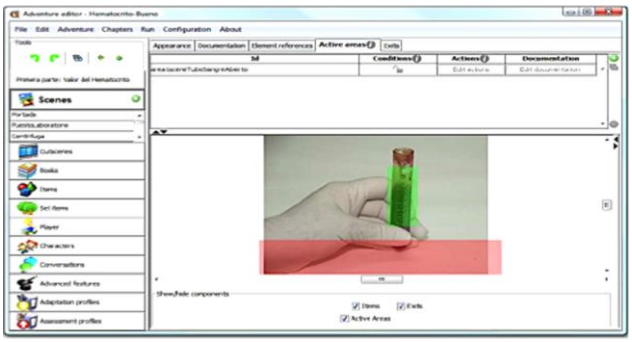

Figure 5. 1: <e-Adventure> game authoring tool.(Torrente et al., 2010)

Second, there is a development methodology so-called "WEEV: Writing Environment for Educational Video Games" to develop story-driven educational games (J. Marchiori et al., 2011). WEEV framework allows non-technical people (i.e. teachers) to develop educational adventure games upon the <e-Adventure> authoring tool. The story driven editor uses a domain specific visual language (DSVL) to describe the game. This language specifically aims for the games of the adventure point-and-click genre and allows domain experts or educators to design the story-flow of games.

The basic element of this language is represented as Mealy finite-state machine (state transition diagram) approach. In this DSVL, the states specify game states (symbolized as circle) that are invisible to the player. As illustrated in Figure 5.2, the initial state (state a) represents the point where the story starts. Transition b indicates the player‟s action (i.e., grabbing an object) and produces an output (feedback to the player) (J. Marchiori et al., 2011).

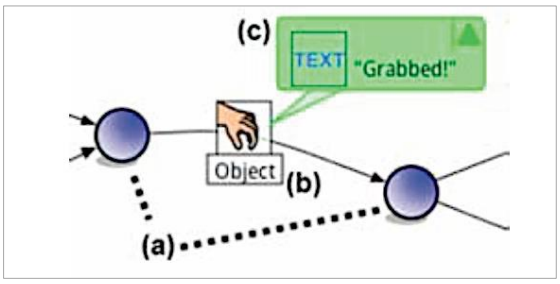

Figure 5.2: The basic elements of WEEV (J. Marchiori et al., 2011)

In this DSVL, possible actions by the player, feedbacks, hierarchical definition of the story flow of the game, and providing specific features for the embedding of pedagogical aspects such as assessment, and guidance indicated as visual elements. In this way, the modeler or storywriter can see and edit the narrative flow and how the interactions of the player influence on the trend of the story (J. Marchiori et al., 2011). As seen in Figure 5.3, the assessment modeled to allow modelers (i.e., educators) score or make evaluation on the player"s actions. It modifies the overall score and indicates a line assessment report. In this case, the activation state of the alarm will increase the overall score by 4, while deactivation of this element will decrease the overall score by 2. Fire protocol is an assessment report, which will be shown when the player did not activate the alarm at first but at a later time.

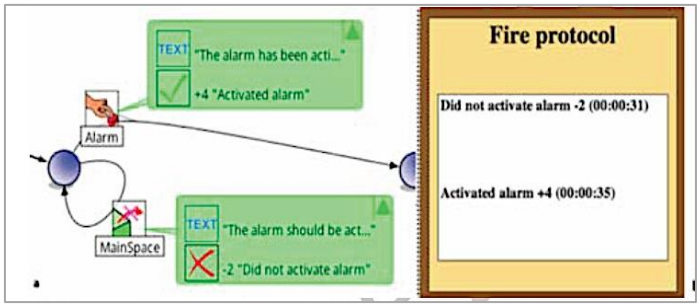

Figure 5.3: Assessment (J. Marchiori et al., 2011)

Finally, the visual descriptions can be automatically translated into a playable educational video game.

ATTAC-L is also a domain specific modeling language (DSML) with a flow-based approach. It is able to specify the major aspects of the game: an abstraction of the story flow; the non-playable characters and objects involved in the game and their roles and characteristics; the potential actions of the player and their consequences (Van Broeckhoven, 2013). ATTAC-L like WEEV is also extended to allow the modeling of the pedagogical aspects of the educational game. For this purpose, a system of annotating the storyline model has been introduced. In this way, the educational or pedagogical aspects are placed on top of the storyline model. This allows the modeler to focus either on the story flow or on pedagogical objectives of the game separately (Van Broeckhoven & De Troyer, 2014). Compared to WEEV, ATTAC-L has a strict separation between the narrative and the learning characteristics, while in WEEV, both aspects are interweaved.

5.2 80Days

The main aim of the 80Days project[16] is constructing adaptive educational technology with interactive and adaptive storytelling. The authoring system StoryTell that is being developed in the context the 80Days project, aims to support non-programmer users in creating story-based educational games.

In the Story Editor component of this authoring tool users can define the overall structure of a story by using the visual language, which draws transitions as arrows between story units. The author can define the logic that follows the flow of events in this scene and the predicted time that the learner will stay in a scene. Users have possibility to define 3D virtual objects such as characters into a specific scene by dragging them from the Resource Center and dropping them onto the Stage Editor. In the ActionSet Editor of this tool, users can determine actions in the scene, shown by boxes, into a tree structure (see Figure 5.3) (Mehm, Göbel, Radke, & Steinmetz, 2012). For instance, this action (i.e., set

[16] http://www.eightydays.eu

as target 1: „Madrid is set as the target city“) applied to this object (i.e., Madrid1), which the author specified in the current scene.

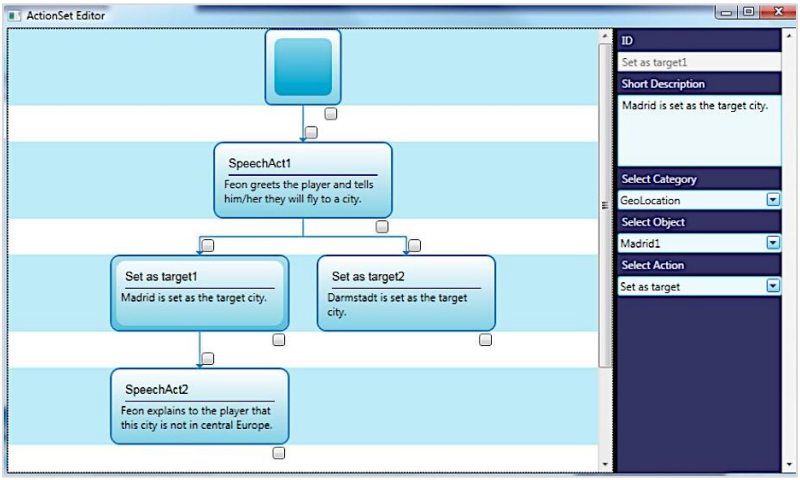

Figure 5.3: Action Set Editor (80Days) (Mehm et al., 2012)

Chapter 6

Conclusions and Summary

The thesis focuses mainly on the ATTAC-L language developed in Friendly ATTAC that aims to create story-based educational games in the cyber-bullying domain. ATTAC-L is a DSML designed to facilitate non-programmer users (modelers) to describe in a formal way (model) the narrative content ("story") of digital (educational) games. The aim of this thesis is to verify the generality of the ATTAC-L language and when needed to propose extensions or adaptations. ATTAC-L is created to model both story and pedagogical aspects of the educational games. Since the current modeling concepts provided to the modeler for modeling the educational aspects are very general; they do not belong to specific learning theory. A better embedding of these education-oriented modeling concepts into specific learning theories could be beneficial and could provide more support to the modeler. For this purpose, we modeled an existing educational video game named Reach Out Central (ROC) in this dissertation. ROC is found mainly based on Cognitive Behavior Theory (CBT) as behavior change theory of this game. SCT is also considered in this thesis since it is mentioned as another behavior change in this game (not very explicitly stated) and it is also a total model for behavior change in video games.

In the first part of Chapter 2, we provided the background information with respect to CBT and SCT. We figured out modeling and feedbacks as essential components for learning in both CBT and SCT. CBT is mainly concentrated on the relationship between the one"s thinking, feeling and behavior. It emphasizes that cognition (thought) can affect feeling and behavior. Cognitive reconstructing was discussed as an important technique in CBT that helps individuals to reject unhelpful or faulty (inaccurate) thinking, with the goal of replacing positive, and rational thoughts. The six steps were explained regarding

to this technique.

SCT emphasizes that cognitive process or personal factors including self-efficacy, self-regulation, outcome expectancy and knowledge are important for behavior modification. Those concepts of SCT and CBT were used in Chapter 3 and 4 of this dissertation.

In the second part, Re-Mission and Escape from Diab video games were examined. The GM-LM model regarding to Re-Mission game was indicated to helped us to understand how game mechanics could be mapped into learning aspects. For this, we played Re-Mission 2 game to elaborate more on mapping and the relationship between the game mechanics and learning mechanics. Therefore, we could get familiar with various game mechanics such as tutorial, cascading information, backstory, feedback, reward, and action point and how they can be useful with respect to learning aspects. Some of these game mechanics were also discovered in ROC.

To figure out how SCT can be mapped into video game, Escape from Diab game was studied. Although we had no access to play this game, but we could get a general idea of behavior change factors that have the influence on the player‟s behavior (see Figure 2.17). As a result, we could get better idea to analyze the ROC game from the perspective of SCT.

In chapter 3, we analyzed the Reach Out Central (ROC) game in order to comprehend how behavior change theories of this game including CBT and SCT can be modeled by means of ATTAC-L in Chapter 4. We concluded that CBT was used to teach the players to understand the relationship between their thoughts, feelings, and behavior at different situations. The cognitive restructuring technique was discovered in ROC (see section 3.2.2) regarding to CBT. It instructs the players to evaluate their negative or realistic thoughts based on various feedbacks they could receive from the game. The mood meter (see section 3.2.4.2) is an essential tool in ROC to demonstrate the level of the player‟s feelings (both negative and positive) at particular situation.

Learning by means of observing models (observational learning) and different kinds of feedbacks were examined. In the modeling part (see section 3.2.3), the player merely

acts as an observer who gets the useful information from the model in order to learn what to do to perform the right behavior. Paul was introduced in ROC as a mastery model (model who demonstrates faultless or desired behavior) since he acts as a trainer who describes the desired behavior to the player. In ROC, the model (Paul) explains the desired behavior to the player through the mobile phone but does not preform or demonstrate practically the behavior (he does not play in the story as other NPCs). Therefore, we modified the ROC scenario for which the model (Paul) was capable to show the right behavior or play in the context of the story in Chapter 4 (see Figure 4.21).

Several core concepts were considered regarding to SCT such as self-efficacy, self-regulation and knowledge. We could infer that ROC is mainly designed from the CBT perspective to teach the players how cognition (thought) can modify the feeling and the behavior. We could discover that SCT is not covered thoroughly in ROC. Although we could find self-efficacy and knowledge as important factors in this game, but self-regulatory activities were not realized explicitly.

In the first part of Chapter 4, we explained the main principles of ATTAC-L that are used to model the story part of the ROC game. Since the whole scenario of ROC was based on multiple question answer between the player and NPCs, then it was not very challenging to model the story part of this game by ATTAC-L. Hence, we could model the story part easily without the need to define or modify the current concepts of ATTAC-L.

In the second part, we introduced annotations that express the pedagogical aspects of the ROC game in more general way. Annotations are placed on the top of the story. The cognitive reconstructing technique was modeled as an objective annotation. We followed up the six steps (Chapter 2, section 2.2.2.1) to model this technique. An example scenario (i.e., break up) from ROC was selected to demonstrate how cognitive restructuring technique could be modeled by ATTAC-L. To inject extra guidance (i.e., game tip) we could take advantage of the inform annotation from ATTAC-L.

Emotional consequence feedback was introduced as an essential annotation to facilitate the modelers to give a feedback to the players in order to inform them about the level of their feelings at different parts of the story. We believe that this annotation can be general enough to be used by other games that follow CBT. This annotation can be categorized as

an action annotation since it is performed and shown to the player as an emotional feedback. It is necessarily feedback that needs to be defined by the modeler in order to satisfy the pedagogical objective (i.e., cognitive restructuring).

Negative thought annotation (action type) could be considered as an extra guidance that shown to the player and purposely designed for games supporting CBT. This annotation gives the chance for modeler to teach the players about various types of cognitive distortions (see Table 2; page 104). In this way, players can identify NATs (cognitive distortions) in the story.

Untwist thinking annotation (action type) could be advantageous for modelers in order to show a feedback that helps the players to identify or think carefully about the truthfulness of the negative thought (NT). We could get the idea from this technique (see Table 3; page 106).

Evaluative feedback annotation (action type) was introduced to evaluate the player‟s performance by the end of each scenario to see whether the player could achieve a goal successfully. This can be used for any objective annotations (attached to a scenario) or game based goal annotations (attached to a game move) to either announce the completed feedback to the player (enhancing the self-efficacy skill) or ask them to rehearse some part of a scenario from where it is specified by the modeler (improving mastery experience skill).

Self-efficacy was also modeled by ATTAC-L since it plays a major role in SCT and generally cognitive learning. The goal of self-efficacy annotation is providing support for the modelers to evaluate the player‟s self-efficacy in the context of the story. Several action annotations could be used to achieve the self-efficacy objective. For example, game based goals, emotional consequence feedback, inform, modeling, and evaluative feedback annotations.

Game based goal annotation can be used in any game to specify the goal to the player by attaching to a certain game move.

We also tried to show how the observational learning could be modeled (see

section 4.1.4.2.1) in a generic way. Modeling annotation was introduced based on the information and definition we could receive from Chapter 2 (see section 2.2.1.1 and 2.4.1.2). To model the observational learning as an action annotation we could figure out the player mostly acts as an observer or passive role in order to get information what to do to perform the right behavior. Besides, a positive feedback can be shown to the player in order to raise the player‟s self-efficacy in the process of observing a model.

Lastly, the score annotation (action type) was introduced to model the scoring system of educational games.

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Appendix

CHECKLIST OF COGNITIVE DISTORTIONS

1) All-or-nothing thinking: You look at things in absolute, black-and-white categories

2) Overgeneralization: You view a negative event as a never-ending pattern of defeat

3) Mental filter: You dwell on the negatives and ignore the positives

4) Discounting the positive: You insist that your accomplishments or positive qualities „don't account"

5) Jumping to conclusions: (A) Mind reading – you assume that people are reacting negatively to you when there's no definite evidence for this; (B) Fortune-telling – You arbitrarily predict that things will turn out badly.

6) Magnification or minimization: You blow things way up out of proportion or you shrink their importance inappropriately.

7) Emotional reasoning: You reason from how you *feel*: "I feel like an idiot, so I really must be one". Or "I don't *feel* like doing this, so I'll put it off."

8) "Should statements": You criticize yourself or other people with "shoulds" or "shouldn'ts." "Musts," "oughts," and "have tos" are similar offenders.

9) Labeling: You identify with your shortcomings. Instead of saying "I made a mistake", you tell yourself, "I'm a jerk", or "a fool," or "a loser".

10) Personalization and blame: You blame yourself for something you weren‟t entirely responsible for, or you blame other people and overlook ways that your own attitudes and behaviour might contribute to a problem.

Table 2: Check lists of Cognitive distortions (D. Burns, 1989)

10 WAYS TO UNTWIST YOUR THINKING

1) Identify The Distortion: Write down your negative thoughts so you can see which of the ten cognitive distortions you're involved in. This will make it easier to think about the problem in a more positive and realistic way.

2) Examine The Evidence: Instead of assuming that your negative thought is true, examine the actual evidence for it. For example, if you feel that you never do anything right, you could list several things you have done successfully.

3) The Double-Standard Method: Instead of putting yourself down in a harsh, condemning way, talk to yourself in the same compassionate way you would talk to a friend with a similar problem.

4) The Experimental Technique: Do an experiment to test the validity of your negative thought. For example, if during an episode of panic, you become terrified that you're about to die of a heart attack, you could jog or run up and down several flights of stairs. This will prove that your heart is healthy and strong.

5) Thinking In Shades Of Grey: Although this method may sound drab, the effects can be illuminating. Instead of thinking about your problems in all-or-nothing extremes, evaluate things on a scale of 0 to 100. When things don't work out as well as you hoped, think about the experience as a partial success rather than a complete failure. See what you can learn from the situation.

6) The Survey Method: Ask people questions to find out if your thoughts and attitudes are realistic. For example, if you feel that public speaking anxiety is abnormal and shameful, ask several friends if they ever felt nervous before they gave a talk.

8) The Semantic Method: Simply substitute language that is less colourful and emotionally loaded. This method is helpful for 'should statements.' Instead of telling yourself, "I shouldn't have made that mistake," you can say, "It would be better if I hadn't made that mistake."

9) Re-attribution: Instead of automatically assuming that you are "bad" and blaming yourself entirely for a problem, think about the many factors that may have contributed to

it. Focus on solving the problem instead of using up all your energy blaming yourself and feeling guilty.

10) Cost-Benefit Analysis: List the advantages and disadvantages of a feeling (like getting angry when your plane is late), a negative thought (like "No matter how hard I try, I always screw up"), or a behaviour pattern (like overeating and lying around in bed when you're depressed). You can also use the cost benefit analysis to modify a self-defeating belief such as, "I must always try to be perfect."

Table 3: 10 ways to untwist your thinking (D. Burns, 1989)