Chapter 9
Designing a General Open Authorable Digital Ecosystem for Educational Games to Support Special Learning Needs

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Introduction

Increasingly, experts, teachers, parents, and students look to technology as a complimentary support for their educations. Currently, ample researches have been done in serious games that cover matters related to education, therapy for communication, psychomotor treatment, and social behavior enhancement. Michael Zyda (2005) defines a serious game as: "*a mental contest, played with a computer in accordance with specific rules that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives*." Serious games for education and health can be combined in a series of impairments such as autism or attention and concentration deficits.

Educational gaming is a great platform that helps in motivating students to learn and is designed to teach students about a specific subject and/or skill. Prensky in (2001) argues that children are naturally motivated to play games. Educational games are interactions that teach students goals, rules, adaptation, problem-solving, and interaction, all represented as a narrative. Such games give them the fundamental needs of learning by providing enjoyment, passionate involvement, structure, motivation, ego gratification, adrenaline, creativity, interaction, and emotion. "*Play has a deep biological, evolutionarily, important function, which has to do specifically with learning*" (Prensky, 2001).

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In general, computer games and other digital technologies such as mobile phones and the Internet seem to stimulate playful goals and to facilitate the construction of playful identities. This transformation advances the ludification of today's culture in the spirit of Johan Huizinga's *Homo Ludens* (Huizinga, 1955). In this context, this ludification of today's culture can be also used in educational activities to strengthen the motivation and the engagement of the students as well as in rehabilitation to maintain patient motivation and interest.

Moreover, the narrative of an educational game plays an important role in its success. The story is the root of the whole gaming experience. Up to now, educational games are usually created with a closed architecture and a single narrative, resulting to fail in providing a more personalized or customized learning procedure.

In this chapter, we introduce the IOLAOS framework for serious games (Vidakis et al., 2014) that can be applied in a wide range of cases (from no conditions to severe) and ages (from toddlers to elderly people). IOLAOS aims to combine ludology and narratology improvements to provide efficient educational and therapy gaming for all.

Regarding the game narrative, IOLAOS suggests a fully authorable editor (implemented using the *Unity* game engine (2014)), with which experts can create templates and carers can shape and customize the template-based games according to specific needs for a more personalized education or rehabilitation. It is important that such customizations can be performed easily and without the reliance on software developers. The editor is also open. This means that new templates can be added easily for creating new games serving new educational or rehabilitation goals.

Regarding the ludic approach, IOLAOS features the use of a natural user interface (NUI). NUI is a human-computer interface that allows humans to communicate with the computer using standard modes of human communication, such as speech or gestures, and to manipulate virtual objects in a fashion similar to the way humans manipulate physical objects. During the last few years, technology has been improved rapidly and allowed the creation of efficient and low-cost applications featuring these interfaces.

One of the characteristics of a successful NUI is thus the reduction of cognitive load on people interacting with it. This is an important feature that makes it a suitable interface in developing, for example, successful learning applications for children. In our design, a NUI (instead of a restricted human-computer interface) is used to enhance playfulness and thus establish a ludic interface. NUI features and focuses also on the kinesthetic factor (gestures, movements, etc.), which is an important element in achieving this playfulness of a ludic interface. For example, it is much more "fun" in a game to drive a car with your hands naturally, compared to pressing some keyboard keys. And this is even more important and critical when the target group is children.

Besides the NUI-based interface, ludic design for the game has been also employed in order to improve playfulness, maintain patient motivation and interest, make the educational games more attractive for the children, and aim to improve the learning and rehabilitation procedure.

Briefly, the IOLAOS project:

- Introduces an open authorable narrative editor for creating templates and customizing educational and rehabilitation (healthcare) games, without the reliance on software developers
- Employs a twofold ludic approach for both the interface (NUI) and the game design
- Aims to a creation of more personalized games that support the educational and rehabilitation activities better

As a proof of concept for the IOLAOS project, a work scenario is presented in this chapter, for creating an educational game for teaching preschoolers with autism spectrum conditions (ASC) to improve their skills in recognizing facial expressions (Christinaki et al., 2014). Facial expressions give important clues about emotions and provide a key mechanism for understanding, identifying, and conveying them. Children with ASC often fail to recognize the qualitative differences and associations between various expressions of emotions (Hobson, 1986). Due to limited social and emotional understanding, they do not know how to adequately interact with other people – a problem which sometimes leads to inappropriate behaviors. Studies have reported that individuals with ASC experience difficulties in recognizing expressions while in youth and experience problems recognizing emotions as adults (Rump et al., 2009).

Treatment approaches and rehabilitation aim to improve social interaction, conquest communication, and control inappropriate behavior. Children with ASC are more likely to initiate positive interaction after treatment (Bauminger, 2002). Education is also considered as a solution for the socio-emotional deficits, and training is claimed to improve face processing abilities and strategies in autism (Faja et al., 2007). A variety of educational interventions have been proposed for children with autism, and many proponents have claimed developmental improvement and other benefits (Eikeseth, 2009).

In this context, this chapter also presents how IOLAOS platform can be used in order to create an educational game featuring playfulness both in playing (NUI) and in designing the game, along with a customized narrative of the game, which can be edited according to the needs. Our aim is twofold: (a) to teach facial emotion recognition to preschoolers with ASC and (b) to enhance their social interaction.

The rest of the chapter is organized as follows: In section "Background", a brief presentation of similar existing work in creating educational games is presented. Section "The IOLAOS platform" focuses on the proposed open architecture of the IOLAOS project. To illustrate the concepts of the proposed architecture, section "Representative scenario" presents the scenario for teaching preschoolers with ASC about expression recognition and how is this possible by using the IOLAOS framework. Finally, section "Conclusion and future work" describes conclusions and discusses future work.

Background

Educational games for children have been widely used in supporting learning inside and out of school, and as a result a growing interest has appeared for the potential of digital games to deliver effective and engaging learning experiences (Hwang & Wu, 2012). There is a variety of computer games and software that intend to assist users to achieve various educational goals. A well-known educational software is the project Scratch from MIT Media Lab (Resnick et al., 2009), a programming language for learning to code. With Scratch users can program their own interactive stories, games, and animations by putting together images, music, and sounds with programming command blocks. Monterrat et al. (2012) in their study claimed that game modding as an educational activity could be interesting not only to learn programming but for any kind of learning. Their pedagogical tool allows people without game design skills to modify and share digital games. It allows a learner to become a teacher by designing an educational game that others can use to learn. Their main idea is that if learning a game helps students to acquire knowledge, then being able to change the game can provide students with the ability to deeply learn the content.

Narrative architecture and ludic design are two major approaches in contemporary video game theory. They both play important roles in teaching and learning as parts of educational gaming. Lester et al. (2013) described the design issues and the empirical findings about motivation in narrative-centered learning environments. They found a strong connection between narrative and educational games, and they claimed that a narrative-centered learning environment is a promising approach for fostering positive learning gains, as well as for promoting student motivation. On the other hand, Padilla-Zea et al. (2014) included digital storytelling in an educational video game and introduced narrative elements to foster the students' motivation in learning processes by integrating specific educational models and ludic aspects. They claimed that ludic tasks in educational games are important elements to maintain students' interest, motivation, and immersion.

During the last decade, researchers have begun to explore the use of computer technologies dedicated to ASC as intervention tools for improving and eliminating different deficits. In a recent review, Wainer and Ingersoll (2011) examined innovation computer programs as educational interventions for people with ASC. They focused on studies describing programs to teach language, emotions, or social skills. Their analysis showed that those tools are promising strategies for delivering direct intervention to individuals with ASC. Bernardini et al. (2014) proposed a serious game for children with ASC to practice social communication skills; they used an intelligent virtual character that acts both as a peer and as a tutor on a number of different learning activities. These activities can be selected manually by a human operator (practitioner, parent, or other carer) through a graphical interface. Their experimental results showed encouraging tendencies by relating the effectiveness of the children's interaction with the virtual character acting as a social partner to them. Porayska-Pomsta et al. (2013) suggest an intelligent and authorable environment to assist children with ASC in gaining social interaction skills. Their tool contains an intelligent agent and a play environment that allows teachers and parents to become cocreators and tailor the game according to the needs of the individual children in their care. Although the design and creation of personalized games is crucial for children with ASC, as reported by the authors, limitations in the agent's intelligence (agent inability to deal with inappropriate or unexpected behavior from the user) contradict the structured, stable, and predictable learning environment that is also crucial. The importance of active family participation in interventions and their collaboration in the research process has also been examined. Wright et al. (2011) conducted a qualitative study to consider a tool to facilitate intergenerational family relationships. Their study examined social engagement among families with a child with ASC and the vital importance of the families in technology-based programs that promote social engagement and self-esteem for children with high-functioning autism. Their findings support technology as a tool to facilitate family and social engagement in children with ASC. Current studies have also gone considerably beyond the simple use of computers. Diverse technology-based interventions have been employed for empowerment and skill acquisition. Recent reviews (Ramdoss et al., 2011; Grynszpan et al., 2014) have shown that there is a growing number of interventions and report a variety of technologies such as interactive DVDs and virtual reality programs (Parsons & Cobb, 2011).

Ludology and narratology can also be considered as two important elements when creating educational games for children with ASC. Game narrative can provide context that assists children to apply the skills learned within the game. Ludology in both the interface and the game design also can engage children with autism in playful interactions and strengthen their motivation. Foster et al. (2010) have suggested embedding interactive narrative in multimodal learning environments for social skill improvement of children with ASC. Castelhano et al. (2013) studied therapeutic activities for children with developmental disabilities with the use of multisensory stimulation environments and documented its perception concerning ludic content and play and the computer-mediated ludic activity. The main theme that emerged from their study regarding playfulness was that the computer-mediated ludic experience is perceived as useful for intervention.

In general, educational computer games for children that combine ludology and narratology can provide an effective and engaging learning experience. Hence, developing learning environments that are both storytelling and play-based by combining narrative and ludicity may empower children to achieve great impact, improve deficits, and gain new skills.

The IOLAOS Platform

The initial design of IOLAOS platform focuses on setting up the operational model for carrying out the codification of educational theories and learning styles as well as the generation of ludic, narrative, and educational games according to the needs, abilities, and educational goals. This design exhibits several novel characteristics, which differentiate an IOLAOS-based game from other forms of educational computer games and platforms. First of all, IOLAOS is not only concerned with educational computer games, but instead, it seeks to provide a guided learning environment for both educators and children, that is, storytelling and play-based, by combining narrative and ludic for harnessing knowledge. Consequently, its primary focus is to enable educators and children with the use of ludology and narratology to perform learning tasks and provide an effective and engaging learning experience. To achieve this, IOLAOS builds on a range of technologies, including semantic web, game engines, and advanced human-computer interaction. Secondly, IOLAOS adopts a knowledge-based, reuse-oriented, and natural user interaction model to attain high quality during the performance of learning tasks.

The Architecture

The proposed architecture has been designed in order to support a game platform that fulfills the requirements of customized narratives, ludic interfaces, and ludic game designing. The narrative is created by the expert and edited by the teacher according to the learning needs and goals by using the template codification and template customization modules of the suggested architecture. The ludology is supported in two ways: first, by creating and customizing ludic-based designed games through the template codification and game compilation components and, second, by employing natural user interfaces to the playing process that enhance the playfulness of the game.

The system architecture (Fig. 9.1) consists of four distinct components that collaborate together to (a) codify all different elements of educational theories and learning styles available and to create templates which are then offered to game developers; (b) compile games through a three-step process, namely, *template customization*, *game creation*, and *utilization definition*; (c) manage learning session and play room attributes; and (d) administer all necessary elements, users and their roles, game engine parameters, etc. Peripheral to the system architecture is knowledge derived from educational theories, learning styles, and classroom practices. The components of our architecture are the *Template Codifier*, the *Game Compiler*, the *Play Room*, and the *System Administration*. The following paragraphs describe in more detail the abovementioned architectural components.

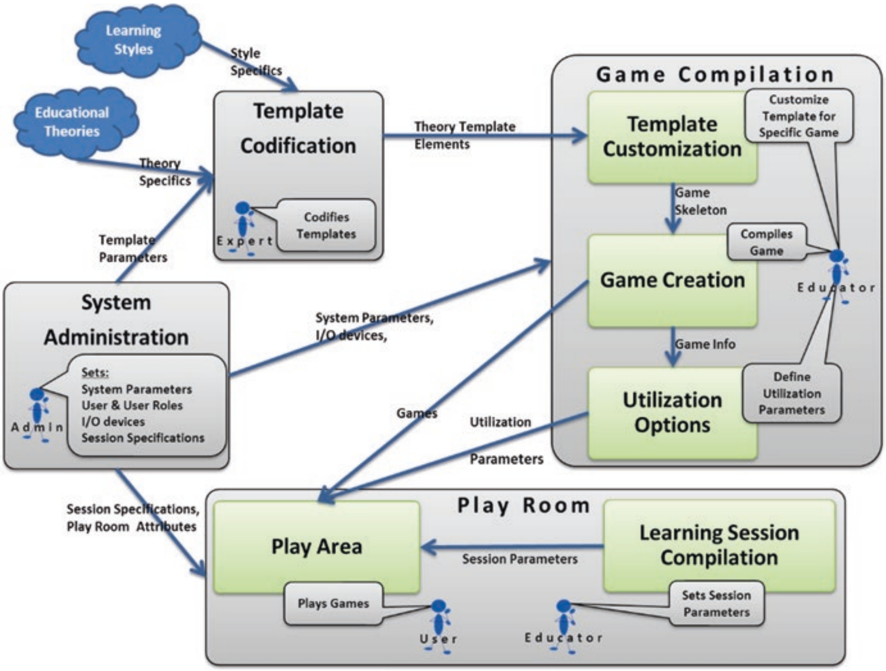

Fig. 9.1 System architecture

System Administration Component

The *System Administration* component (Figs. 9.1 and 9.2) of the system is responsible for managing system attributes, template parameters, game elements, artifacts and behaviors, session attributes, input/output modalities, and user accounts and roles.

The Template Codification Component

The *Template Codifier* component (Figs. 9.1 and 9.3) of the system is accountable for systemizing/codifying the various elements of the educational theories and learning styles. This is achieved by imprinting the theory's elements using a tabbed stepwise process by the expert. Apart from the first steps that imprint basic information about the theories, the process has no strict order of step execution. The template codification process that has been developed in IOLAOS in different tabs (Fig. 9.3) gives the user the capability to define the theory's elements in an organized and clear manner. The imprinting of the educational theories and learning styles is performed by the role "Expert." The different groups of data that have been developed in IOLAOS for imprinting the theory's elements are as follows: "Template Basic Info," "Style Basic Info," "Target Group," "Scenery Basics," "Audio/Motion," "Play Environment," "Rewarding," "Feedback," and "Evaluation" (Fig. 9.3).

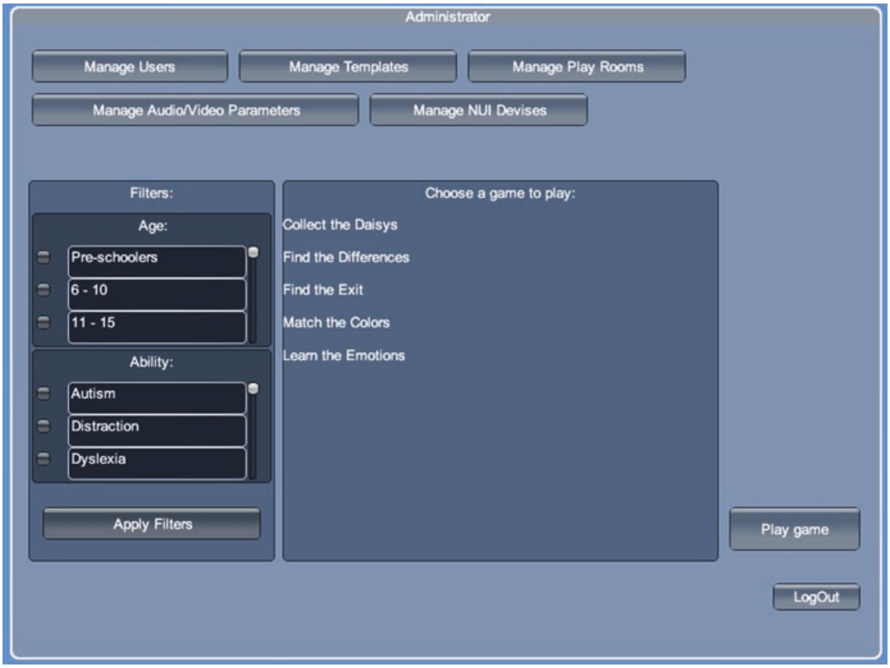

Fig. 9.2 IOLAOS administrator main screens

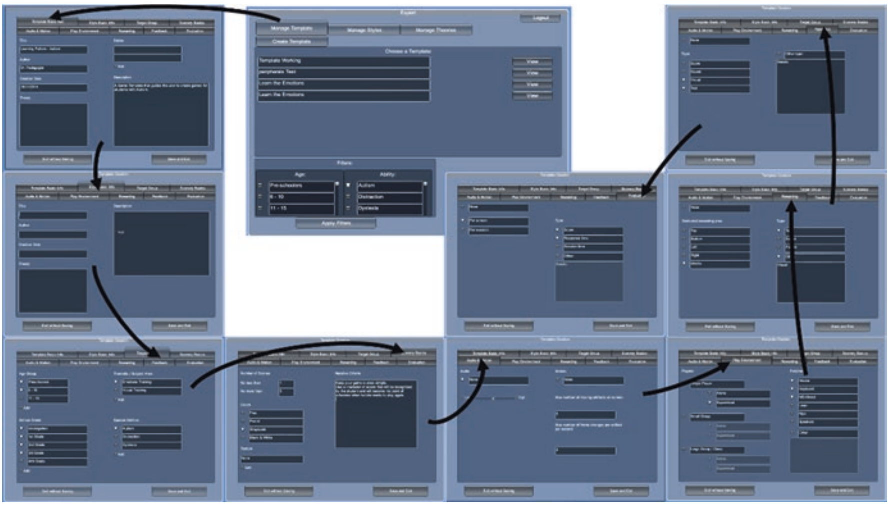

Fig. 9.3 The IOLAOS template codification and customization

In more detail, the theory's imprinting elements elucidate in:

- *Template Basic Info* records general data such as Title, Description, Theory based upon, Template Author, Creation Date, etc.
- *Style Basic Info* records data concerning the learning style such as Title, Description, Theory based upon, Template Author, Creation Date, etc.
- *Target Group* records data concerning player details, abilities, and thematic areas such as Age Group, School Grades, Thematic/Subject Area, Special Abilities, etc.
- *Scenery Basics* deals with data concerning the storytelling that is involved in the game. Such data includes Number of Scenes, Color Information, Texture, Motion, Narrative Criteria, etc.
- *Audio/Motion* records data concerning the use of sound and image input/output modalities such as Audio (yes, no, scalable), Motion (yes, no, number and frequency of moving artifacts), etc.
- *Play Environment* documents data with reference to the type of game (i.e., single player, small group, etc.), the environment played (i.e., supervised or not supervised), and the peripherals used (i.e., classic I/O devises, NUI devices, etc.).
- *Rewarding* deals with data concerning the rewarding of the player such as type of rewarding (i.e., textual, sound, movie, puzzle, etc.).
- *Feedback* records all necessary information about feedback before, during, and after the game flow (i.e., text, sound, movie, score, etc.).
- *Evaluation* deals with data concerning the evaluation of the player (i.e., evaluate per level or per game or per game section, etc.) as well as the evaluation type.

The Game Compilation Component

The *Game Compiler* component (Fig. 9.1) of the system consists of the *Template Customization*, the *Game Creation*, and the *Utilization Options*. It is responsible for providing the "Educator" with the necessary tools to set up a ludic educational game. In other words, it gives the "Educator" the possibility to (a) customize the generic template set up by the "Expert" at the *Template Codification* component in such a way that suits the specific game requirements (Fig. 9.3) needed according to the target user group abilities and goals to be achieved, (b) create a ludic game with the use of the tools provided by the IOLAOS platform, and (c) to define game utilization parameters such as Free Use, Registered User Only, etc.

In more detail, at the "Template Customization" step of the "Game Compilation" component of the architecture, the user chooses a predefined abstract educational template that suits its game criteria and proceeds to tailor this abstract template to the specific necessities of its current game. Figure 9.4 shows the IOLAOS platform elements that enable the user to tailor the abstract educational template discussed above. Elaborating at the first screen of Fig. 9.4, the user chooses game creation which triggers a series of actions before the actual game construction (Fig. 9.5). Initially, the user chooses the predefined abstract educational template (top right screen, Fig. 9.4) and then tailors the template (bottom screen, Fig. 9.4) to suit the

Fig. 9.4 The IOLAOS Template Customization

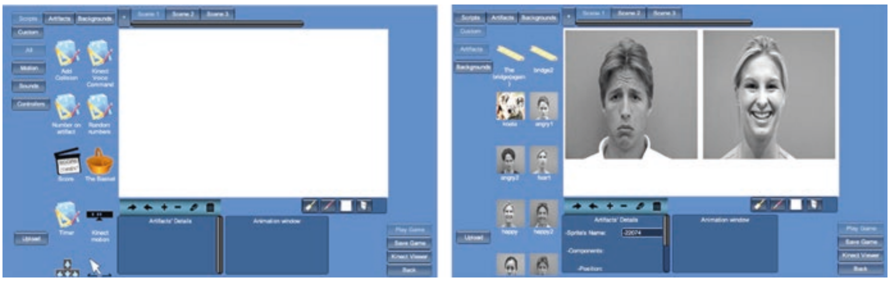

Fig. 9.5 The IOLAOS Game Creation. The face stimuli used and presented are from the CAlifornia Facial Expressions (CAFE) dataset. (Dailey et al., 2001)

specifics of its game within the educational boundaries that the chosen abstract template stipulates.

Once the abstract template has been customized, the user proceeds to construct the actual game with the use of the game creation editor provided by the IOLAOS platform. The game editor provides the user with a number of tool sets that allow a ludic, stepwise, effortless, straightforward, and uncomplicated game creation. This assemblage of tool sets includes the following: (a) a game object tank with predefined game objects, scripts, and backgrounds as well as facilities for custom object creation; (b) game scene management facility with scene navigation, addition, and deletion; (c) game canvas management with gridding, sizing, locating

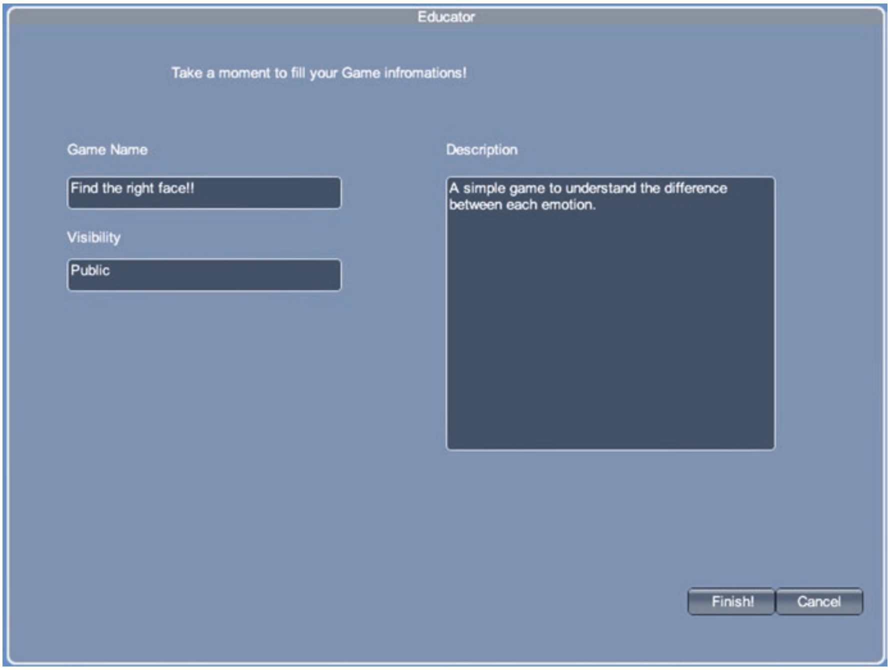

Fig. 9.6 The IOLAOS Utilization Options

options, etc.; and (d) game construction previewing facilities (see left screen of Fig. 9.5).

Upon completion of the game construction, the user proceeds at the final step of the "Game Compilation" component, namely, the "Utilization Options" (Fig. 9.6). At this step utilization options such as game visibility (public or private), target game players, etc. are defined.

The Play Room Component

The *Play Room* component (Fig. 9.1) is responsible for setting up the appropriate space for playing games and consists of "Learning Session Compilation" and "Play Area."

The *Learning Session Compilation* provides the "Educator" the ability to fully manage learning sessions according to individual, group, or class requirements every time she/he needs to run an educational game. In particular the "Educator" can determine (a) Players and/or Group, (b) Marking/Evaluation Specifics/ Procedure, (c) Session Statistics, and (d) Session parameters. She/he can also save incomplete learning sessions in order to be completed in the future.

The *Play Area* deals with the game runtime specifics such as save, load, single player or multiplayer parameters, etc.

Representative Scenario

Individuals with autism are usually visual learners, which mean that they understand written words, photos, and visual information better than spoken language. Information is good to be presented through their strongest processing area. When teaching individuals with autism about emotions, it is important to keep explanations as simple and as concrete as possible. It is also recommended to describe each feeling pictorially by using pictures with clear outline, minimal details, and color (Dodd, 2005). For young children it is advisable to keep to the basic emotions. In our approach, the basic emotions selected include happy, sad, angry, scared, and surprised. Those emotions were chosen because typically developing children can recognize and understand them between 2 and 7 years of age. The face stimuli we used are grayscale photographs of male and female faces, taken from the CAlifornia Facial Expressions (CAFE) dataset (Dailey et al., 2001). This dataset was selected as the most appropriate with respect to the emotion recognition task since all images meet FACS criteria (Ekman & Friesen, 1978) and all faces have been certified as "FACS-correct" (Smith et al., 2005). The stimuli are presented on each trial with different pairs of photos, and the goal is to choose the correct image.

To illustrate some of the concepts described so far and to provide insight into the features of IOLAOS platform, we will briefly describe a representative scenario emphasizing on ludic, narrative, and authorable game creation for educating children with autism diagnosis. Our reference scenario is summarized in Exhibit 9.1. For more details see (Christinaki et al., 2013).

Exhibit 9.1
The game begins with an instruction page where the child is informed what is going to happen, what she/he has to do, and how she/he can do it. A two-hand gesture which is performed by moving both hands above the head is required to start the game. In the first level, children should learn labeling emotions by correlating emotion terms with images. The stimuli are presented on each trial with different pair of photos, and the goal is to choose the correct image among the two. Selecting the left image (the orientation of the image is decided by looking toward the screen) requires a one-hand gesture which is performed by moving the left hand above the head. Selecting the right image (the orientation again of the image is decided by looking toward the screen) requires a one-hand gesture which is performed by moving the right hand above the head. Upon correct answer the "$\surd$" symbol appears on top of the image, while upon incorrect answer, the "x" symbol appears on top of the image. Moving to the next play area requires a two-hand gesture, which is performed by moving both hands above the head. In the second level they should learn to recognize emotions from their description and their association with facial features. In the third level they should learn to identify the causes of various feelings in different situations, obtained through the use of social stories. At the end of the game, there is a congratulations message.

Game Compilation

According to our reference scenario, the “Educator” creates the game by performing the following steps in IOLAOS platform: (a) select appropriate template, (b) customize template according to scenario requirements, and (c) generate game framework upon which the “Educator” will construct/fabricate the game, by defining artifacts and behaviors. The outcome of the above process is an educational game for children with autism diagnosis for recognizing emotions.

In more detail, the “Educator” selects “Create Game,” and at *step 1* (“select appropriate template”) she/he selects the appropriate template provided by IOLAOS, in our case the “Learning Pattern – Autism” (Fig. 9.7).

At *step 2* (“customize template according to scenario requirements”), the “Educator” applies the scenario requirements which in our case are as follows: (1) the number of game levels is limited to 3, excluding welcome screen and final screen, thus a total of 5 scenes, (2) feedback is passed to the player through symbols for her/his choices (the “√” symbol for correct answer and the “x” symbol for wrong answer) during game execution and as concluding feedback at the end with the form of a congratulations message, and (3) game navigation is performed either by hand gestures with the use of MS-Kinect NUI device (raise left hand, right hand, or both hands) or the mouse pointing device (Fig. 9.8).

At *step 3* (“generate game framework”) the platform allows the “Educator” to construct the game (Fig. 9.9) by using the artifacts and behaviors provided by IOLAOS according to desires and boundaries set up at *step 2*. More specifically, in our representative scenario, the educational template “Learning Pattern – Autism” has been chosen. This template designates that no colors are permitted when constructing a game. Following the chosen template restrictions, the platform provides only grayscale artifacts to be used in the game. The “Educator” creates a game based on the generic template “Learning Pattern – Autism” for children with autism diagnosis that fits the specified group abilities and goals, namely, emotion recognition. The outcome is a ludic educational game for preschoolers with special abilities and specific educational goals and is presented in detail in the next section.

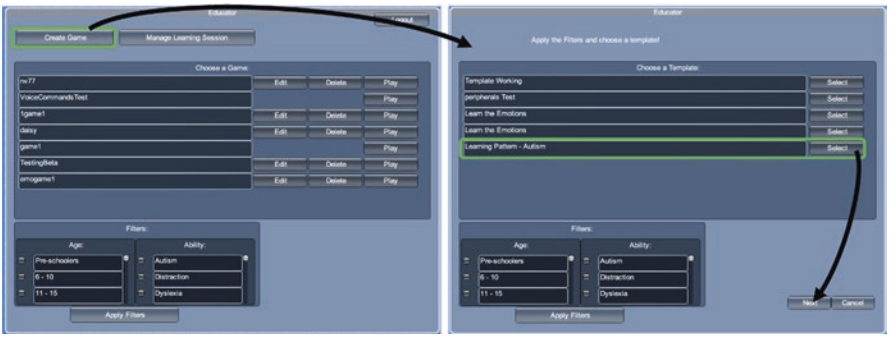

Fig. 9.7 Educator Create Game *step 1*: “select appropriate template”

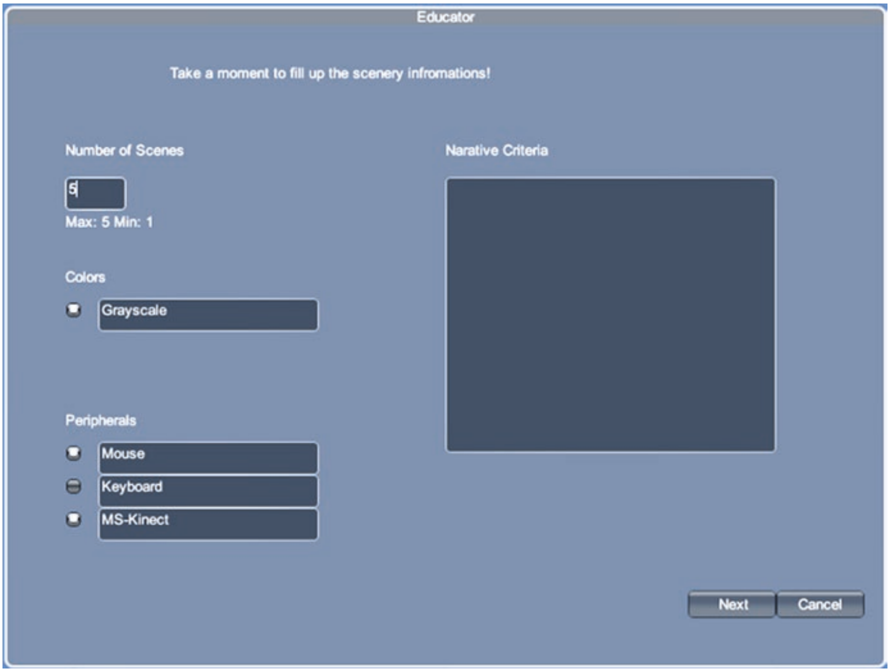

Fig. 9.8 Educator Create Game *step 2*: “customize template”

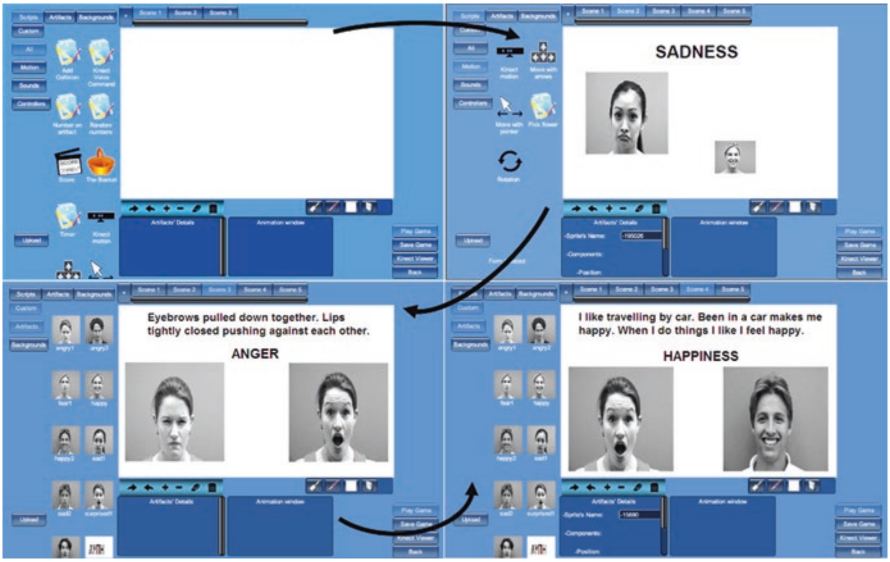

Fig. 9.9 Educator Create Game *step 3*. The face stimuli used and presented are from the CAlifornia Facial Expressions (CAFE) dataset. (Dailey et al., 2001)

Play Game

At the previous section we have described the "Game Compilation" process based on our representative scenario. This section elaborates on playing the game by children with autism diagnosis in their school settings and in supervision by a kindergarten teacher. Detailed results and findings about our survey on preschoolers with ASD which are analyzed into emotional state versus game performance, emotional state versus surroundings, concentration and game performance, and NUI device and game acknowledgement can be found at (Christinaki et al., 2014).

The game environment is kept simple in order to avoid children's distraction. Individuals with autism are reported to have enhanced perception of details (Ashwin et al., 2009) which may cause distraction. For these reasons the selected educational template denotes the use of black context presented on a white background and grayscale stimuli. Black and white contrast may also help to increase and retain child's attention and keep them focused on the screen.

The game begins with an instruction page (Fig. 9.9, top left scene) where the child is informed what is going to happen, what she/he has to do, and how she/he can do it. Apart from the text on the screen, audio instructions are also provided. Audio cues are important as the information presented is clear and age-appropriate. When the child feels ready, she/he can choose to start the game. The game provides a structure learning environment which consists of three different levels with increasing difficulty (Fig. 9.9, scenes labeled "SADNESS," "ANGER," "HAPPINESS"). Breaking the teaching intervention into small learning steps makes the task easier to perform. In the first level (Fig. 9.10, scene labeled "SADNESS"), children should learn labeling emotions by correlating emotion terms with images. In the second level (Fig. 9.10, scene labeled "ANGER"), they should learn to recognize emotions from their description and their association with facial features. In the third level (Fig. 9.10, scene labeled "HAPPINESS"), they should learn to identify the causes of various feelings in different situations, obtained through the use of social stories. Those three levels provide recognition, matching, observation, understanding, and generalization of facial emotions.

Computer-based interventions that use a keyboard or a mouse for interaction might cause problem with the younger children which may not be able to use a computer. Our gesture-based interaction approach moves the control of computer from a mouse and keyboard to the motions of the body via new input devices.

Our game is designed to use non-touch-based NUI and to be controlled by hand gestures. The gestures are translated into control commands. The player has three possible actions in all game states, to choose left or right image and move to the next play area. These basic actions are implemented with efficient and easy-to-use gestures. Moving to the next play area requires a two-hand gesture which is performed by moving both hands above the head. Selecting the left image requires a one-hand gesture which is performed by moving the left hand above the head. Respectively, selecting the right image requires a one-hand gesture which is performed by moving the right hand above the head.

Fig. 9.10 Representative scenario (Christinaki et al., 2013). The face stimuli used and presented are from the CAlifornia Facial Expressions (CAFE) dataset. (Dailey et al., 2001)

During the game, if the player selects the correct or incorrect stimuli, the system will inform the player that she/he gave the correct or incorrect answer. Each answer provides an audio and a visual feedback such as operation-related sounds and appropriate marks above the selected image ("√" for correct answer and "x" for wrong answer). A voice telling "Bravo" rewards the player for the correct answer, and a voice telling "Try again" encourages the player to try again when the user provides an incorrect answer. There are no other sound effects because individuals with ASD may suffer from auditory sensitivity (Gomes et al., 2008), may demonstrate oversensitivity to certain sounds even at low volume, and may feel discomfort when exposed to certain sounds (Tan et al., 2012).

Conclusion and Future Work

In this chapter we have attempted to sketch the organizational underpinnings of the IOLAOS – a pilot effort aiming to build an open authorable framework for educational games for children by combining ludology and narratology. Our primary design target is to set up an operational model for carrying out the codification of educational theories and learning styles as well as the generation of ludic, narrative, and educational games according to the needs, abilities, and educational goals and to support this model with appropriate software platform and tools.

Ongoing work covers a variety of issues of both technological and educational engineering character. Some of the issues to be addressed in the immediate future include the following: (a) elaborate on the learning session compiler, (b) further explore learning styles and educational theories in collaboration with expert and educator professional associations, (c) run various use cases in vivo with the guidance and involvement of expert and educator professional associations, (d) enhance ludology aiming not only to children experience but also to experts and teachers, and (e) introduce further involvement of multimodal NUI devices so that the roles between game player and machine are reversed and the player performs gestures, sounds, grimaces, etc. and the machine responds. Moreover, IOLAOS could also offer valuable contribution to develop effective games for rehabilitation. Based on the work scenario presented in this chapter, we have demonstrated the feasibility of using this platform to create serious games that combine education and health. Therefore, this operational model must be further studied.

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