**DELIVERABLE D1.3**  
**Summary reports on user requirements and specification**

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<tr>
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<th>289021</th>
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<tr>
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<tr>
<td>Project title</td>
<td>Integrated Internet-Based Environment for Social Inclusion of Children with Autism Spectrum Conditions</td>
</tr>
<tr>
<td>Contractual date of delivery</td>
<td>31 March 2012</td>
</tr>
<tr>
<td>Actual date of delivery</td>
<td>31 March 2012</td>
</tr>
<tr>
<td>Deliverable number</td>
<td>D1.3</td>
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<tr>
<td>Deliverable title</td>
<td>Summary report on user requirements and specification</td>
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<tr>
<td>Type</td>
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<tr>
<td>Number of pages</td>
<td>32</td>
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<tr>
<td>WP contributing to the deliverable</td>
<td>WP 1 (User Requirements and Specification)</td>
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The research leading to these results has received funding from the European Community’s Seventh Framework Programme ([FP7/2007-2013] [FP7/2007-2011]) under grant agreement n° [289021]

Versioning history

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Appendix 1:  
A Virtual World for Children in the Autistic Spectrum Condition – A Requirements document
Definition of user requirements – a progress report

Four resources of information served for collecting data for the definition of user requirements:
1. Meetings with children diagnosed with ASC and their families (focus groups)
2. Professionals panel meetings
3. An online international survey (partial results)
4. Background from academic literature and market sources

The initial information gathered from these resources was already reported in the former deliverables (D1.1 and D1.2). In accordance with the DOW requirements this is an ongoing "spiral" process. Following is a newly gathered data that was collected in this ongoing process.

1.1 Focus group 2nd session analysis

This analysis is based on the BIU team’s second session with the focus group's children and parents. The sessions were held during March 2012.

Objective: ASC-Inclusion aims at creating a virtual environment (VE) for children with ASD, to teach them about the recognition and expression of emotions. Therefore, the first evaluation sessions were meant to study the impressions of children with ASD towards an existing VE, named Zigazu, which was designed for typically developing children.

While the first session (reported in D1.2) was focused on FIRST impressions and a situation of play with an unfamiliar environment, the current session's purpose was to further study the children’s emotional reactions, cognitive comprehension, and behaviorally - their ability to operate the VE, after the children and parents played in the VE for a few weeks and had the chance to explore and get to know it better.

Another objective was to study the children and parents reactions towards several game genres, so as to define possible challenges and preferences in this respect.

Finally, an additional VE environment named Mikmak, (also designed for typically developing children) was presented to the children, with the aim of validating the impressions formerly reported for the Zigazu VE by adding more data about the children's abilities, comprehension and emotional attitudes to a differently designed VE.

Participants: Eleven children took part in this evaluation session, 10 boys and 1 girl (Mean age=95 month (7 years and 11 month), SD=1.77)). Ten of the children were between 5-10 years of age. Although not within the target group's planned age range, we included one participant aged 10:9. We considered it to be of great value to receive feedback from an older child who has better verbal ability. All children were diagnosed with an autism spectrum condition by trained clinicians, based on established criteria (DSM IV/ICD 10). The participants are listed in Table 1.
Table 1: The evaluation’s participants (who participated in this session)

<table>
<thead>
<tr>
<th>Participant ID</th>
<th>Gender</th>
<th>Age (y:m)</th>
<th>Diagnosis</th>
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<td>Asci-014</td>
<td>Male</td>
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Two children did not participate in the March session.

Procedure: During a 2 hour meeting with the child and his parents, a semi-structured observation was conducted, which included:

- About 40 minutes free-play in the Zigazu VE
- About 10 minutes interview with the child about the Zigazu VE.
- About 20 minutes free-play in the Mikmak VE
- About 10 minutes interview with the child about the Mikmak VE.
- About 30 minutes directed play in pre-selected games representing different game genres
- About 10 minutes of reflection on the games.

The research team recorded the child’s answers to the interview questions, as well as the child’s spontaneous comments during play.

Results

1. Children’s attitudes towards the Zigazu VE after playing for a few weeks
   Generally, the children kept the positive attitudes they expressed towards the Zigazu VE in the first session. They reported that they have played in Zigazu several times since the first session, and were glad to return to it and play in it again. Most of them seemed to easily operate the VE independently. Most began touring the VE with no help.

2. Emotional reactions to the Zigazu VE
   When asked about liked and less liked activities in the VE, each of the children named a few activities/elements they liked. Some noted activities/elements they didn’t like or liked less than others, and usually explained why.
   - Games/activities that were liked by at least 3 children:
     - Creating your own drawing (6 children)
     - Strategy and thought (“mazes” and “the zig-zag is hungry”) (8 children)
Inventive thinking riddles (3)
"Tetris like" games (6)
Puzzles (3)
Matrix games (3)
Pet (6).

Applications/elements that were liked by at least 3 children:
- Linko – the linko is sort of a messenger adopted for young children with pre-defined phrases, backgrounds and stickers with which children can communicate with other children in the project who agreed to be their "friends". Many (5) of the children used it and some (4) mentioned as one of their favorite activities.
- Interactive TV with video clips about science, animals etc. (5)
- Interactive collections/albums (5). One child even noted that for him, the interactive albums were the main reason for playing Zigazu (though this child also noted many other activities that he played and liked. Some children (3) suggested more themes for the albums: machinery, cars, famous singers, famous paintings, football.
- NPC's: (NPC= Non Player Character. Namely, an animated pre-defined character in the VE.) - 6 children said they liked NPC's in the VE: 4 liked the helper character (a ginnie), 1 liked 2 other characters. All the children liked the Halfners! (fluffy mischievous creatures).
- Themes: In the Zigazu VE there are several content areas where the design and activities are around a certain theme. The following themes were liked: The animals' sanctuary (Safari) area (3 children), the science/math area (3 children).

Games/activities, application or element that the children liked less or didn't like:
- Two of the children noted a game that they didn't like. (Matrix game (1 child), "Garbage monsters" (1 child)).
- One child noted that a game was too easy for him (mazes).
- There was no activity/game, application or element that more than 2 children noted they did not like.

Level of difficulty and challenge:
- There was no game that was mentioned as "too difficult". But a child was observed to leave a game he was playing because it seems to have frustrated him. Another child was playing a game in a level that was clearly under his abilities, and the experimenters' impression was that it was because he was reluctant to deal with the frustration of trying a more difficult level.
- In only one case a specific game was mentioned as “too easy” (by 1 child). But some children (3) said they wanted to have more challenges in the games and seek for more difficult games or levels of play.
3. General comments and attitudes towards the Zigazu VE

- Interest over time: It was reported for the first focus group meeting, that most of the children wanted to keep on playing in the VE beyond the time requested for the evaluation, e.g., they continued to play when the examiner talked to their parents, and even when the examiner was leaving. This was also true for this session and the parents and children reported the children played in the VE several times during the time since the first session. This might imply a long term interest in the VE beyond natural child enthusiasm towards new activities.
- Virtual home: Children suggested that the virtual home should be more "designable" and said they would like to buy things for their homes and make more changes in it.
- Avatar design: Children (5) expressed interest in having a more elaborated avatar, namely being able to see it in full body, choose its cloths, and have it present and active in the VE activities.
- Pet: as with the avatar, the children's' reaction to the pet fish in the Zigazu VE was very positive but they wanted to have more possibilities of playing with it, grooming it, buying things for it, etc.
- Achievements and rewards: some children (2) suggested "a place where all your trophies and prizes are saved", so you can always come there and see how you proceed. Some (2) referred to the need to gain "all sorts of rewards, not just virtual coins" and suggested trophies, accessories, play time, object that will allow you to go into new places, and "objects that you collect part by part, like a mission". One child remarked that a certain game was "not fun because when he played he did not receive any reward".
- Voices: one child noted some voices that were annoying to him (high peached voices).
- Linko – although many children liked it as mentioned above, it should be noted that one child merely "collected friends" but didn't really communicate with them. Another child recoiled from the Linko.
- One child was not attracted to the Zigazu VE altogether.

4. General comments and attitudes towards the Mikmak VE

- Most children (6) knew Mikmak VE and stated they have played in it and liked it. One child, however, was reluctant to go into it saying he knew it and it was "very scary". When asked what was scary he said: "the music, the plots, and the achievements mountain".
- The children liked a lot the "walking avatars" in this VE, and the presence of other children's avatars though very crowded did not seem to bother most (7) of them. One child liked to have an active avatar but said the other children's avatars make the game difficult for him.
- The younger children (2) didn't use the communication features between the avatars. One child was very enthusiastic about
communicating with other children through the avatar options, and one was totally uninterested in doing it.

- The children like the "collectables" and presents they earned for their achievements.
- Well liked games (noted by more than 3 children): "four in a row"/diamonds (strategy), "collect the stars"/"fire ball"/"the magic balls" (arcade), riddles.
- Asked about the helps and the "helper" character, the children noted that they prefer a talking helper as in Zigazu, rather than textual help as in Mikmak. The younger children who are pre or beginning readers needed the mediation of adults when they didn't understand a game or a task. But even the older children who can already read found it more helping to have the help in voice rather than text.

Summary and conclusions

- **General:** After having played for almost a month, the participants in this focus group still found the Zigazu VE attractive, enjoyable, easy to use and clear to understand.
- **Avatar:** The recommendation to include an avatar the user can design in the planned VE, and to give it an active role, made after the first evaluation session, still holds, and even stressed following the second session.
- **Automatic vs user controlled stimuli:** in the former report it was stated that the children responded well to the "hot-spots" that activate animations. In addition to their entertaining role, these "hot-spots" appear to provide the child with a sense of control, since their activation is entirely the child’s choice. Moreover, since some of the children felt uncomfortable with the animations that appeared unannounced, it is recommended to keep the activation of all "hot spot" animations subject to the child’s choice.

  The current evaluation showed that even after a substantial period of play, letting the children get used to the VE, some of the children still found the "surprise" animations and voices disturbing. Feeling uncomfortable with unexpected and unfamiliar stimuli is a well-known characteristic among ASC children, and so, these guidelines still hold.
- **Game Genres:** While the children showed some preference to logic, strategy and thought games, they played all sorts of games. Some genres were liked by some children and disliked by others.
- **Home, Pet, interactive collections and albums:** It was observed that those features are very strong motivational elements and it is recommended to include and even further extend them in the VE.
- **Communication with other children:** This was feature was found to be a motivational feature for some of the older children, but might be unattractive for the young ones, and disturbing to some older/younger children. Hence, it is recommended to include it in the future software, but in an optional manner so as to let the children who choose to use it benefit from it, but enable children who are not interested or even disturbed by it to ignore it.
1.2 Specialists' panel 2nd session analysis – the extended panel

The specialists’ panel of 5 psychologists that was assembled and reported on in the February report was extended to include more professionals with expertise in the field of autism. Apart from psychologists we included occupational therapists and speech therapists, all with rich experience of working with ASC children, so as to have their special perspectives on the project.

Eight professionals participated in the current panel: 3 psychologists, 2 occupational therapists, 2 speech therapists, and 1 special education supervisor from the ministry of education.

The objective of the panel was to receive the professionals' views regarding the main issues that were defined following the first panel and after the sessions with the children. Some questions also aroused from some work that was done by COMP on the design of 3-4 example activities.

The panel begun with a short presentation of the Zigazu VE, and the participants were asked to comment on the user experience: which elements and features are recommended and which might be challenging or disturbing for children with ASC.

The following issues have been discussed:

1. **Choice and control:**
   Some specialists in the group thought that in some cases there was too much choice in the user experience. For example, it was stated that there were too many options for where to go to when entering the portal main menu of the VE, too many options to choose from for the avatar character, and so on. While the older children can enjoy it, (and indeed they required it as reported in the focus group’s results section) the younger children might feel intimidated or confused by it.

2. **Rewarding elements and policy:**
   The concept of teaching children within a virtual world concept relies heavily on harnessing the power of the VE to create a motivation to learn, even a subject that might be very challenging for the ASC children to cope with, like emotions. The issue of rewards and motivational elements is therefore a very central one.

   The issue of virtual money as a main and quite prominent element in the VE, bothered some of the participants in three aspects:
   
   a. It implies a very "capitalistic" and "technical" approach to rewards.
   b. The younger children might find it unclear; they might not be able to understand the large and complex numbers that represent the amount of coins they earn.
   c. Some ASC children like numbers very much and they might put an extensive focus on the virtual money that may interfere with the learning process.
COMP stated that virtual money is a basic feature of a VE that the children expect and love, and apart from being a main motivational factor by itself it is also the basis for many more motivational features, like the ability to purchase virtual goods for your avatar, home and pet; distinguishing between beginners and advanced users, and so encouraging the children to advance in learning; and the ability to reward children differently for wanted activities by letting them earn more on them than on activities that become less "learning advancing". (For example, to encourage a child to advance in the learning material and not "get stuck" on the easy initial material, the system can reward them with more coins on novel activities they try, than on activities they already exhausted). In addition, the virtual money is only one element of the rewarding system, and other motivating rewards can be integrated into the rewarding policy too, such as play time in certain areas, collectibles for the virtual collections and albums, and so on.

The group recommendation following a discussion of these issues was to have virtual money in the ASC-Inclusion VE but to keep the number of coins low so that the young children can understand it; To make the indications of the virtual money quite subtle so that they will not attract too much of the children's attention too much; and finally, to also supply diverse rewards apart from virtual coins.

3. Feedbacks policy:
Based on COMP's work on some example activities (games) for the learning section of the project, it was asked if a feedback when the child makes a mistake should always include the right answer so as to teach the child the expected answer or reaction. The question aroused because, while the didactic value of such guidance is acknowledged, such a feedback might harm the game "pace" and sometimes even make it somewhat tedious. It was agreed that if the fun aspect of the game is badly hurt then the children might not want to play it and so lose the didactic value of it anyway. The conclusion is, therefore, that an effort will be made to have "didactic" feedbacks with the right answer or reflection or guidance where possible, but to avoid it and settle for a short "mistake" sound as common to games in cases it might "spoil the game".

In general, it was also agreed that the children should get a lot of positive feedbacks so as to empower them and give them a feeling of success and confidence. Feedbacks can be vocal, visual and animated, as fits each game. Feedbacks on mistakes should be subtle and encourage the child to try again.

4. Generalization considerations:
As in the first session, the focus group wondered if training merely through serious games will have sufficient effect on the ability to generalize the learning into real life situations.

Suggestions and ideas:
1. It was suggested that a module for carers (therapists/parents) will be developed, that will enable them to assign real world tasks to the children and reward them with virtual rewards within the VE.

2. To include a list of ideas of "real world" games and activities that will help the child practice and generalize what he/she had learned.

3. To encourage the carers to use the VE as a tool for reflection on the child’s feelings when playing (happy for a success, frustrated with a difficulty in a game, and so on).

**The requirements document**

Following the work done until now for WP1 – User requirements and specifications, a summary report was written by COMP. This document includes the Functional specifications and Technical specifications of the future software, based on the user requirements as defined until now on the basis of the 4 sources of information mentioned above, as well as the ongoing work of the teams and the project's clinical team Tel-Aviv meeting in the end of March.

The document is attached to this deliverable as Appendix 1.

**Existing content that can be used in the content building (WP6)**

### 3.1 A skeleton for the training program

A skeleton for the training program of the project was assembled by BIU and discussed in the March Tel Aviv clinicians' team meeting.

#### 3.11 ASC-Inclusion project - Training model

**Training model:**

1. Introduction
2. Unit 1: What emotions are
3. Unit 2: The basic emotions
4. Unit 3: Emotional and mental dimensions
5. Units 4-6: Complex emotions
6. Unit 7: Integration
7. Unit 8: Complicating factors

**Introduction**

TBD

**Unit 1: What are emotions?**
• Definition.
• The internal experience of emotions
• Why emotions are important in real life
• Why emotions are important in the VE

Dilemmas:
- The physical aspects of emotions: How does it feel in the body?
- The evolutionary aspect of emotions.
- Communicational aspects of emotions

Unit 2: The basic emotions
• 6 basic emotions: happy, sad, afraid, angry, disgusted & surprised.
• Definition for each emotion
• the contextual occurrence of each of the basic emotions
• the physical aspect: How does it feel in the body
• Recognition of each emotion throughout the various modalities (facial expression, voice and body language).
• Expression of each emotion throughout the various modalities.
• The social-environment and my emotions (how are other people affected by my emotions, how do they react)

Unit 3: Emotional and mental dimensions
• Definitions of the 6 dimensions of:
  1. Intensity/arousal
  2. Valence
  3. Direction to other
  4. Direction to self
  5. Time (brevity, past-present-future)
  6. Frequency?
• Variations of the different dimensions with basic emotions.

Unites 4-6: Complex emotions
• Definition for each emotion
• the contextual occurrence of each of the basic emotions
• the physical aspect: How does it feel in the body
• Recognition of each emotion throughout all the modalities: face expression, voice and body language.
• Expression of each emotion throughout all the modalities.
• The environment and my emotions (how does other people are affected from my emotions, how they react)

   Emotions groups:
   (Basic)
   Individual (directed to self)
   Social (directed to other)
   Self-conscious
   Situational vs. Cognitive?

Unit 7: Integration
Using tasks and games that integrate:
  1. Various emotional concepts
  2. Various modalities
3. Both recognition and expression
4. Contextual understanding

Unit 8: Complicating factors
Conflicting messages
- Hidden or toned down emotions related to self restraint or “display rules” (good manners, “white lies”)
- Expressing one emotions to conceal another (e.g., anger to conceal shame).
- Conflicting messages in different channels. E.g.: Irony, sarcasm.
- Mixed emotions

Attention allocation in real life settings
- Perception of partial information (e.g. hidden face, sun glasses, noise)
- Perception of brief stimuli
- Need for fast response in social situations.
- Dealing with competing stimuli.
- Group feelings – how emotions are shared in a group.

3.1.2 General issues and considerations in the training model
- Emotions in each of the modalities: voice, face & body language.
- Expression & recognition
- Training through virtual games.
- ToM
- Generalization
- Variability – different people respond differently, no one gets it right all the time.
- Cultural and sub cultural variability

3.2 Interactive content
The two types of interactive content that were reported in the former deliverable, prepared in order to extend the initial information collection and user's requirement definition, but can also serve WP6, were further extended/developed during February and March. They were:

An adapted version of the Zigazu VE, Example interactive emotion games.

a) An adapted virtual environment
   The objective was to study the children's emotional reactions to the VE, their cognitive comprehension of the VE, and, behaviorally, their ability to operate the VE. The VE chosen was a site for children called Zigazu.

   Some features were adapted to help meet the ASD children needs and testing goals in light of the conclusions and recommendations from the first focus group session and the first specialists' panel.
   1. Letting the child control sensory stimuli: an "on/off" button was added to let the child control the background music.
   2. Removal of "surprise" and loop animations, and turning automatic animations to clickable "hot-spots" so that they will only appear when the child chooses to click on them.
   3. Exposure of more content and games to the children in order to define their preferences in terms of game genres.
The children's reactions and feedback were summarized above in this report.

b) **Example interactive emotion games**

The two example interactive activities that were reported in the former deliverable, with the purpose of learning the possible constraints of emotions learning content within the context of games and other VE features, were developed and indeed aroused some questions that were brought up in the discussions of the experts in the specialists panel, as well as in the project clinicians team Tel-Aviv meeting. Their views, reported above, will direct the work of further developing more games and activities.

Another purpose of developing those games is of course to test them with ASC children. Having discussed some of the issues, and having chosen the theme for the VE in the clinicians March meeting, those games will now be adapted to the requirements and designed according to the chosen theme. When ready they will be tested with the focus group children during April/May.

Three additional activities were also defined for the same purposes:

1. **A basic memory game**
   
   **Didactic purpose: teaching the 6 basic emotions:**
   
   i. Level1: Match a happy face with an identical happy face. (only happy faces will be presented). [6-8 cards]
   
   ii. Level 2: Match a happy or a sad face with an identical one. (happy and sad faces only will be presented). [8-10 cards]
   
   iii. Level 3: Same task as in level 2 but adding afraid. [10-12 cards]
   
   iv. Level 4: Same task as in level 2 but adding angry. [12-16 cards]
   
   v. Level 5: Same task as in level 3 but adding surprised and disgusted. [16-20 cards]

   Every time the child picks a card the name of the feeling on it will be heard, so as to help him/her to learn it.
   
   Children will automatically get a hint if they don't play for a few minutes. They will also be able to get a hint any time they wish to by clicking the "hint" button. The hint will be: two matching cards will show for a few seconds, and the name of the feeling shown in them will be heard.
2. **An advanced memory game**  
   **Didactic purpose:** generalization and practice of all 27 learned feelings:  
   Task for all levels: Match two different people that are feeling the same.  
   i. Level 1: [6-8 cards]  
   ii. Level 2: [8-10 cards]  
   iii. Level 3: [10-12 cards]  
   iv. Level 4: [12-16 cards]  
   v. Level 5: [16-20 cards]  
   The name of the feeling will be heard as a feedback only after the child picked a pair. Hint as described above.

3. **"How would Erik feel if..."**  
   **Didactic purpose:** practicing TOM (Theory of Mind), i.e. trying to imagine how someone else will feel in a certain situation.  
   The game will be designed in the format of a trivia game TV show (such as "Who wants to be a millionaire"). The content of the "questions" will be short descriptions of everyday situations. (For example: "Erik came home from school and found his room all messy, how would Erik feel?") The answer and destructors to choose from will be 3 or 4 videos with the character expressing different emotional states. The child's task will be to click on the video where the character's expressed feeling matches the formerly described situation.  
   i. Level 1: Simple situations, 6 basic emotions. [2 destructors]  
   ii. Level 2: More difficult situations, more advanced emotions [2 destructors]  
   iii. Level 3: More difficult situations, more advanced emotions [3 destructors]  
   iv. Level 4: Complex situations and emotions [3 destructors]  
   v. Level 5: Situations involving "hidden emotions" [3 destructors]  
   The child will be able to choose different kinds of hints according to the rules of the game format.
3.3 Experts and opinion leaders survey

The "Experts and opinion leaders" was finalized and sent to relevant people in Europe and around the world. The survey was held during March, and 49 people participated. Highlights from the results of this survey were presented and used in the discussions of the Clinical team Tel Aviv March meeting.

The data is still being analyzed and the full report will be distributed when finalized.

For the future, we see this survey as a basis for further surveys to be held as the project advances. While this survey was aimed at collecting general data of experts and opinion leaders' views about the basic concepts of the project, to better define user requirements, further surveys will contain more specific questions on features and applications in development, and will address specifically to the different potential users groups of the software, Namely:

- Parents of ASC children who will hopefully purchase the software for their children for home usage.
- Field workers – therapists, teachers and volunteers who work with ASC children and will hopefully be using it as a tool for teaching emotions in the clinic.

**Summary of conference calls to consortium partners relevant to user requirements**

**February 20 2012**: clinical partners' evaluation meeting.

Main issues which were discussed:
- **Evaluation**: Discussion of the process of evaluation the tools that will assess the changes in the various modalities.
- **Emotion list**: Discussion of the emotions list to be taught in the project. Preparing the final list towards the clinicians meeting in Tel-Aviv.

**March 7 2012**: clinical partners' evaluation meeting and focus group. Main issues which were discussed:

- **Focus groups**: An update on the progress of work with the focus group in Israel site. Plans for further focus group meetings in Israel site.
- **Towards the clinicians meeting in Tel-Aviv:** Agenda and AR's. Material to be prepared and discussed in the meeting.
  - **Evaluation**: Issues to be discussed in the Tel-Aviv meeting.

**Meeting on users requirements** – Monday 26th March 11.00 (Brussels)- Skype

**March 26 2012**
**MINUTES – Meeting on user requirements**

**Participants:**
Aurélie Baranger & Nikki Sullings – Autism-Europe
Daniel Lundqvist - Karolinska Institutet
Noga Meir – Compedia
Shahar Tal – Bar Ilan University
Erik Marchi – Technische Universität München

1- **Objectives of the meeting / adoption of agenda**
All participants accepted the draft agenda.

2- **Task 1.1: Progress towards Identifying the audience needs**

- **State of play regarding the review of socio-emotional training needs of children with ASC and their carers**

Noga provided a summary of the work that has been done so far on the socio-emotional training needs of children with ASC and their carers, as well as the discussions that have taken place on this topic at the recent meeting in Israel:

The recent meeting in Israel (March 19-21, 2012) was attended by representatives of Karolinska Institutet, Compedia and Bar Ilan University.

At the meeting, participants discussed issues of project specifications for both children and therapists. Compedia presented initial technical specifications for the project. The final technical specifications will be determined according to the users’ requirements as defined by the research that is currently being conducted by Bar Ilan University (BIU). Extensive work has already been done by BIU, collecting information from the children's focus group and the professionals focus group. For the children's focus group, the already existing game called ‘Zigazu’ (which was developed by Compedia)
has been used as a reference point for the research. Shahar and Shimri went to the homes of the children twice to collect their feedback on using Zigazu. The BIU team recorded the children’s reactions to this game and its virtual world – including the emotional aspects, usability and understanding of the tasks within the context of the virtual world. The first visit to the children’s homes aimed to gather their first impressions of using the game and their first impressions of the game’s virtual world. The second visit to the children’s homes took place a month later and aimed to gather information from the children such as whether they still liked the game and its virtual environment, and whether the children had adjusted to the aspects of the game and virtual world that may have been unfavourable or distressing to them at first. The main conclusions of this research were published in the first report that was produced by BIU in February.

Noga is currently working on the second report, which is due at the end of March. This report will include the findings of additional research including research with the specialist panel and the results of the experts and opinion leaders survey. The specialist panel includes psychologists as well as speech and occupational therapists. This panel has provided very interesting input for the research, which will be detailed in the report. The experts and opinion leaders survey has also been very useful, with 48 people responding. The respondents gave useful information and comments, as well as many comments supporting the project as a whole. The respondents also included a person who has autism and is the leader of an autism association.

Noga concluded that the research has been very fruitful overall and they have gained many ideas and conclusions about the requirements for the games and virtual environment. She also noted that additional surveys may be conducted as part of this research, as required.

She explained that the upcoming report will also address some important issues, including the issue of how to make the software elements (music, games, virtual environment) as customisable as possible in response to the various sensitivities of children with autism in relation to sensory stimulation, and personalize the game according to each individual. Similarly, elements such as virtual pets could be exposed to children who use the software gradually, or settings in relation to this could be changed in advance by therapists.

- State of play regarding pedagogical Specification

Noga began by explaining that the pedagogical specification is the translation of the recommendations from the research with children and professionals into technical specifications.

She explained that at the meeting in Israel, a training model was presented by the BIU team and decisions were made about emotions to be taught in the project. Decisions were also made about which emotions would be taught in the software program. The participants discussed the best ways to integrate emotion teaching into the virtual environment, as well as its connection with the reward system.

The academic evaluation of the project was also discussed by the participants, including the issue of the large number of tasks to be evaluated (facial expressions, body gestures and vocal intonation), and the integration of these elements, as well as the critical issue of how to evaluate the generalisation of skills that children learn from the software. The group decided to evaluate the project on 3 levels:
1 – children’s learning within the context of the software platform
2 – children’s learning in relation to novel stimuli a different computerised context
3 – generalisation of skills learned by children to real life (to be evaluated through questionnaires for parents/therapists)

Noga informed us that the details will be provided in the minutes from the Israel meeting, which will be distributed within a day or two…

- Identification of technological Opportunities and Constraints.

Shahar informed the meeting about the technological opportunities and constraints.

She explained that during the first year of the project there will be a focus on integrating the emotion learning components without the virtual world. Meanwhile, Compedia will start creating and testing some components of the virtual world.

Noga added that there will be options for children to play with different games/components that have the most appeal to them (bearing in mind children have different tastes in games). She explained that the components and virtual world will be based on principles of thinking, learning and fun, though there will not be guns or violent elements that appear in many other computer games.

Shahar continued that there is an issue to be resolved regarding the schedules for evaluation of different components of the software. The participants at the Israel meeting concluded that they would like to unite the schedules for phase 2 and 3 of the evaluation, as they believe there will be many benefits to doing so. Uncertainty remained over whether this will be possible, as phase 3 of the evaluation aims to test the whole integrated software system.

Uncertainty about the between schedules – when can the evaluation start? Potentially uniting phase 2 and 3 of the evaluation – this could bring many benefits. But is this possible? Phase 3 is supposed to test the whole integrated platform.

Also, the participants at the Israel meeting felt puzzled by the very large amount of filming that will take place in Cambridge for building evaluation tasks, which will be the responsibility of Simon’s postdoctoral researcher who is scheduled to begin in the next month. The participants felt there is a need to communicate clearly with this new person over this issue.

Erik responded regarding the technical aspects of the project. He explained that a basic prototype of the software will be provided in the first year of the project. At this time the system components should be functional, albeit not integrated into the platform. He said the technical partners should be able to begin the evaluation at that stage. He said that TUM should be able to provide the first APIs definitions (the functions needed for integration of the platform) next month. He expected that they will soon have a basic idea of how to integrate the aspects of the software. Erik suggested that the issue of evaluation should be discussed in person at the upcoming meeting in Brussels (on 21 April, Saturday morning).

Shahar clarified that they’d like one big evaluation phase, not separate evaluation phases, which would involve the creation of a new schedule for evaluation.

Erik agreed that they would be happy to discuss the possibility of the new schedule for evaluation at the April meeting in Brussels. An agenda item could be added regarding evaluation scheduling and technical issues.

►Report on the Tel Aviv meeting involving clinical partners
It was agreed by the meeting that all the important aspects of the recent meeting in Israel had already been covered during the previous agenda items.

The meeting was concluded.
Appendix 1

VIRTUAL WORLD FOR CHILDREN IN THE AUTISTIC SPECTRUM CONDITION

Requirements Document

Author: Ilan Goldberg
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15-March-2012
## Document Change log

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Author</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>0.9</td>
<td>12.3.2012</td>
<td>Ilan Goldberg</td>
<td>Basic requirements based on discussions with the clinical partners in the project, a focus group with children, and a survey with opinion leaders</td>
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1. Introduction

1.1 Purpose of the document
The purpose of this document is to define the system requirements from the user’s point of view. User requirements define system functions that users can see and system properties that users are ready to use and stakeholders to pay for as it gives them real value. In addition, this document outlines the technological requirements which are necessary to support the user’s requirements.

The requirements in this document include
- Functions that the system must do
- Properties that the system must have
- Functional or technical constraints on the system.

Table 1: Possible readers of this document

<table>
<thead>
<tr>
<th>Group of the readers</th>
<th>Reasons for reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project partners</td>
<td>To give feedback about the user requirements</td>
</tr>
<tr>
<td>System developers</td>
<td>To understand what functions and properties the system must contain</td>
</tr>
<tr>
<td>Testers</td>
<td>To test the system against the requirements</td>
</tr>
<tr>
<td>Project team</td>
<td>To follow-up the status of the project against the requirements</td>
</tr>
</tbody>
</table>

1.2 References
Following is a list of references to this document:

Table 2. A list of all other relevant documents

<table>
<thead>
<tr>
<th>Name of the document / source of input</th>
<th>Short description of the document contents</th>
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<tbody>
<tr>
<td>Deliverable 289021 - D1.1.doc</td>
<td>Initial report and analysis on user requirements and specification</td>
</tr>
<tr>
<td>Deliverable 289021 - D1.2 - Second phase user requirements report.docx</td>
<td>Second phase report and analysis on user requirements and specification</td>
</tr>
<tr>
<td>ASC-Inclusion Tel Aviv Clinicians meeting Minutes - 19-03-12.doc</td>
<td>Meeting summary of the clinician and Compedia regarding the virtual world's user requirements</td>
</tr>
<tr>
<td>Experts and opinion leaders survey</td>
<td>An online survey conducted with expert clinicians throughout Europe</td>
</tr>
<tr>
<td>ASC professionals' panel</td>
<td>A panel conducted with ASC experts and clinicians by BIU in Israel</td>
</tr>
</tbody>
</table>

2. System overview
ASC-Inclusion is a virtual World aimed to assist children with Autism Spectrum Disorders to understand and express emotions through facial expressions, tone-of-voice and body gestures. This software will assist them to understand and interact with other people, and hopefully, as a result, will increase their inclusion in society.
3. Goals

The system has both academic and commercial goals. On the academic side, the system applies and researches various methods and technologies to help Children with ASC to improve their emotional understanding and expression and thus help their inclusion into society. The system will test face, gesture and voice recognition technologies developed by the project partners. On the commercial side, the system aims to provide an affordable and accessible solution to caregivers, parents and of course children that suffer from autistic spectrum conditions.

4. User groups

This section describes intended users of the system.

Table 3. Users of the system

<table>
<thead>
<tr>
<th>User group</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children with ASC</td>
<td>Children use the system to learn and practice understanding and expression of emotions in daily situations</td>
</tr>
<tr>
<td>Parents</td>
<td>Parents accompany their children while playing with the system, monitor their achievements and receive additional related information in the Parent's Site</td>
</tr>
<tr>
<td>Caregivers</td>
<td>Caregivers provide the system to their patients (children with ASC); they can monitor and configure the parameters of the system to the requirement of every specific child, and can get usage reports with clinical relevant info. They can use it in their clinics with the children as part of their sessions together and can assign &quot;home missions&quot;.</td>
</tr>
<tr>
<td>Researchers</td>
<td>Researchers use the system to develop and test their new hypothesis, technologies and inventions for the benefit of the target audience.</td>
</tr>
</tbody>
</table>
5. Functional requirements

This section defines the services that the system provides to the users, divided into all the user groups. The services were defined using general use cases as shown below:

- **Children**
  - Create a character (AVATAR)
  - Build your personal home
  - Interact with other characters
  - Learn and practice lessons about emotions
  - Play games about emotions
  - Advance in level and "hierarchy"
  - Earn coins and buy virtual goods for your avatar and your home

- **Parents**
  - Enroll your child to the system
  - Control and monitor your child’s experience in the game
  - Get additional clinical information
  - Interact with other parents of children with ASC
  - Provide your child with virtual rewards and/or missions

- **Caregivers**
  - Enroll your patient (child) to the system
  - Adjust the learning plan of the patient in the system to the specific requirement of the child
  - Get sophisticated usage reports
  - Interact with other ASC caregivers and institutes
  - Assign your patient with generalisation challenges
  - Provide your patient with missions and virtual rewards

- **Researcher**
  - Apply methodology, know-how or technological tools to the project
  - Test the tools on ASC children
  - Improve the tools and get new insights
  - Research the usage of this system as a complementary medical tool for ASC children

* The System's design document will include a very detailed account of each and every use case
6. Special Requirements

Since the children that use the system suffer from Autistic Spectrum Conditions this product should apply the following special requirements:

6.1 Generalization

One of the biggest challenges of the program is how to ensure the generalization of the learned content and the application of the computer lessons in real life situations. The software should encourage offline (not in the computer) activities to rehearse the materials learned in the virtual world. Hence the software requirements are:

- To enable the caregiver to define "real life assignments" for the child, i.e. mission and tasks that the child needs to do in real life situations. For such missions the system will be used only as a "motivating reminder".
- To enable the caregiver to reward the child with "virtual rewards" like coins, experience points, virtual goods etc. for successes in the above real world missions
- To provide parents using the software with offline games and activities to do with their children to practice and generalize the online learned materials

6.2 Levels of Difficulty

The children that will use the system are at different ages (5-10) and with different Autistic Spectrum Conditions. Therefore the software should

- Provide various, very distinct levels of difficulty
- Provide easy to use UI to control the level of difficulty, either for children, parents, and caregivers
- Provide personalized experience for each child, based on automatic analysis of actual usage
- Provide different scale of levels to gameplay and emotional learning

6.3 Level of "Stimulation" and "Distraction"

Some of the children that will use the game might find too much interactivity, sound, and animation on the screen distracting. Therefore the system should enable the users (children, parents and/or caregivers) to configure the following parameters:

- The use of music and audio, that might distract the concentration of some of the children
- The use of few/many other players' characters moving around the screen
- The detail of graphics (where possible)
- The intensity/frequency of non-solicited animations on each screen
- The number of clickable options in menus, screens, and games according to level of difficulty
- The use and the type of "surprise animations" in the game (especially for positive feedback). Some children may find non-user-controlled on-screen animation as aversive.

6.4 Principles of the Teaching Parts in the Software

While it is important to let the therapist/parent and the child control some of the world's characteristics, some principles must be followed in the teaching parts:
1. It is important that the child will follow a linear predefined path in the learning process, all of it without the possibility to skip, and in the predefined order.

2. It is essential both from didactic and research points of view, that there will be a "test task" with clear criteria for "passing" before a child can terminate a learning unit and proceed to the next one.

3. It is needed to enable "going back" and re-learn/re-practice units that were already completed, since children sometimes "lose" what they have already mastered. Such can be also being promoted thru system recommendation in cases the child fails to do correlated mission/activity.

4. It is optional and yet to be considered if the caregivers will have some influence on the order of the learning, once possible, as they many times know what are the child's main difficulties. It can be also implemented thru the "mission" sub-system. However, it might be advised that all children will go thru all the phases – and even if they know the basic learning chapters they will still reinforce it and get positive "gaming" experience with the system.

6.5 Safe and Monitored Experience

Some interactive experiences while playing virtual world could be aversive to children with ASC. For example: when another player's characters leave the screen suddenly, or when another player's character won't answer your communication. Therefore, the system is required to identify virtual behaviors that might be offensive to children with ASC and to provide them with guidance on how to cope with such cases. Thus, such experiences become a chance for learning and coping instead of offending or confusing the player. Nevertheless, the system should minimize the offensive social experiences in the game to minimum, far beyond "normal" virtual worlds.

6.6 Content & Gaming Elements

6.6.1 Game Genres

From the accumulated experience of the clinical team, the surveys and the focus groups there is not distinguished gaming genre that should be included or excluded from the games range. Therefore:

- The virtual world will include a variety of gaming genres appealing to most of the children in the target ages
- The software will collect usage information about the gaming habits of the players and will provide statistics to enable the clinician to analyze the preference of the target audience
- Clinician will continue to perform focus group in order to weed out significantly aversive game genres

6.6.2 Multiplayer Options

Virtual worlds usually use multiplayer features as part of their core since:

- They encourage social interaction and the children can learn from it.
- They can be a strong motivational factor.
- They are a standard in virtual worlds. The children expect to see them.
- The child might feel "alone" in a world with no characters but his.

Yet, we do need to adapt the system to the end users requirements as follows:
• NPC (non-player characters, system automated) are allowed in every level of the game since their behavior will be strictly determined by the clinicians according to conduct properly
• Avatars of other players will be introduced to the game only in more advanced levels (as will be described in the detailed design document)
• There won’t be any "free play" multiplayer gaming between to players because lack of mediation can lead to unwanted and uncontrolled results

6.6.3 Pure Fun Games
Pure fun games without any educational part have the following benefits:
• It’s a strong motivational tool.
• Children need recreational activities while learning.
• If all the activities in the virtual world will force the child to deal with the content of emotions that might be challenging or even disturbing to him/her, they might not might not want to play in this virtual world altogether.

On the other hand pure fun games can distract the child from the learning tasks and emotional games. Therefore it is required that every game will include some emotional or educational element to some extent or to limit the usage of fun games, in case it will be advised to be used, after all.

6.6.4 Competitions
The project team sees competition elements as more disturbing than beneficiary for Children with ASC. Hence, the system should provide only collaborative gaming and not competitions. Where children play for high scores in a game, the system should only show the scores of the current player and not the score of other players.

6.6.5 Mix Between Learning and Motivation
Motivational elements include:
• Creating your character and purchasing elements for it, advancing in levels and hierarchy
• Building and equipping your home
• Playing engaging games

We should make sure that children are not stuck on motivational activities that are, naturally, easier and more enjoyable for them. We therefore should apply a playing mechanism that will encourage and sometimes force the children to use the learning elements of the product. In general, it should supply motivation to wanted activities and negative or no feedback to unwanted activities/behaviors. Such mechanism can include positive rewards (like experience points only achievable in the learning chapters) or activity rewards (you cannot play specific games or have specific features unless you learn another chapter).

6.7 Dealing with unwanted use patterns
ASC children sometimes tend to repeat a task extensively or show untypically deep interest in a particular detail rather than seeing the whole context. This might happen in the virtual world too, which might hamper achieving the teaching goals. The software should motivate the children to move forward through the content and not "get stuck".
• The system should be able to recognize unwanted patterns of use, to be defined by the clinical team. For example: when a child is extensively engaged in a certain activity
and does not proceed to other activities, or is not active at all, or fails a "test" activity too many times.

- If such a pattern is recognized, the child should receive a vocal and visual prompt. For example a prompt to proceed or try other activities. And the parent/caregiver might receive a notification (an optional and e-mail) reporting about it, and hopefully will perform mediation or corrective intervention. The system can also do automatic activities like blocking activities that used above the maximum allowed usage (e.g. more than 5 times a day).

- A smart, clear and rich feedback and rewarding system should motivate the children to proceed in the learning process. This will be done with the tools of virtual worlds like: ranks, "extra bonuses", experience points. For example, the child will be rewarded with lots of virtual coins for a new activity she/he will engage in, but after having achieved mastery of this activity's task the amount of coins he/she will earn will be reduced. The child will then be prompted to advance to new activities where he/she can earn more coins, experience points (that help him to go to the next level) or rewards.

- The system will not necessarily automatically limit play time in a certain activity. On the other hand, extra play time of loved activities can be used as a motivating reward.

6.8 Individual or One-On-One Learning
The virtual world will be designed for independent work of the child or in one on one session with therapist/caregiver only. It will not be designed to be used in a school-class context.

6.9 Parent/Caregiver Notifications
The system will notify (with reminders thru e-mails) the parents/caregivers reports on the child progress whenever the child successfully completes a learning unit and proceeds to the next or having some other significant progress. The purpose of this is to keep the parents involved in the child's activity in the virtual world, and hopefully also give him/her child positive feedback for progressing. The system might enable such feedback mechanism between caregivers and children thru the "communication" mechanism (e.g. enable the caregiver to respond to the notification on special achievement with virtual reward and/or positive verbal feedback. This specific communication between caregiver and its patient can be free text).

The virtual world will be designed for independent work of the child or in one on one session with therapist/caregiver only. It will not be designed to be used in a school-class context.

6.10 Translation and Localization
In order for children to be able to use the virtual world and benefit from it, it must "speak their language" – i.e. be translated and localized into their mother tongue. The product is meant to be translated and localized to several European languages. Therefore, it will be built to enable a quick and easy translation and localization process.
7. Technical or Functional Constraints

- The system must run, at least with its basic features, on a normal home or clinic computer
- To use the face and gesture recognition the computer must be equipped with a camera
- To use the speech analysis option the computer must be equipped with a microphone
- Supported operating systems are: Windows and Mac to the basic version, Windows for the extended version (with speech, face and gesture recognition)

A full, comprehensive Technical Requirements document is part of the Game Design Document