# PICO'S ADVENTURE

## A GAME TO FOSTER AND SCAFFOLD SOCIAL INITIATION

# USER MANUAL AND USE PLAN

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Pico's adventure" is a game for <u>children within the Autistic Spectrum Disorder</u> (ASD) aimed toward <u>promoting social initiation</u>. The project is part of the European Project M4All and was developed as a collaboration between the "Cognitive Media Technology Group" of Universitat Pompeu Fabra and experts of the "Specialized Unit on Developmental Disorders" (UETD) of Hospital Sant Joan de Déu, both in Barcelona.

The game addresses skills related to social initiation, understood as the promotion of behaviors such as: approaching and looking for others, trying to start social communication, and producing any verbal or gestural behavior for communicative goals. Its goals are to scaffold social interaction between an ASD child and parents, caregivers or other children.

The game has been designed to work as a <u>mediator of social interaction</u>, aimed at promoting interpersonal relationships. Because of this, the game <u>should not be played by the child alone</u> and requires the <u>constant supervision of an adult.</u>

## *General information about the game*

The game is aimed at promoting a set of target behaviors defined by experts as necessary to foster skills related to social initiation in children within the Autistic Spectrum Disorder.

### *Which children is this game designed for?*

The game has been designed for and tested with children between 4 and 7 years old with mid- to high-functioning autism. However it is possible that the use of the game can be extended to a wider range according to the functional level of the children. The game is not suitable for children diagnosed with neurological disorders that could interfere with the interaction with technology (e.g. epilepsy).

### *Why social initiation?*

Social impairment is probably the most important deficit in ASD children and social initiation represents a fundamental aspect for the proper development of social skills. Even if ASD children can learn to respond to social initiations started by others, they may present major difficulties in initiating this social interaction by themselves. As a result, social interaction as a two-way human activity may be compromised. Furthermore, research shows that an increase in the rate of social initiation, leads to a significant improvement in a wider range of social behaviors.

### *Which kind of behaviors does the game addresses?*

The experts of the "Specialized Unit on Developmental Disorders" define the necessity of addressing skills related to social initiation such as looking for others and approaching them, making eye contact, showing joint attention, starting social communication and producing any verbal or gestural behavior for communicative goals. Starting from this necessity the following target behaviors are addressed in the game:

> - *Use of Instrumental and Conventional gestures*
> - *Stimuli discrimination*
> - *Turn-taking*
> - *Imitation*
> - *Joint Attention*
> - *Vocalization*
> - *Recognition of basic emotions*
> - *Cooperation.*

### *How to use the game?*

The present game works on Windows 7 or Windows 8 computers, further details about the installation and the system's requirements are provided in the Section 2 **"Technical Manual".**

⚠ The game is not designed for an unsupervised use by the child. The child must be accompanied by an adult at all times (e.g. parent, caregiver, therapist, etc.). Its usage is designed according to a treatment plan defined by experts, which details both the appropriate conditions for usage and instructions for the caregiver or accompanying adult. Hence, we currently can only recommend to use the game according to these instructions, provided in Section 3 **"User Manual".**

# TECHNICAL MANUAL

## *Hardware requirements*

The current version of the game has been developed for an average home PC computer with a similar system configuration to the one below:

| | |
|---|---|
| CPU: | Intel i3 / AMD A6 |
| Memory: | 4 Gb RAM |
| Hard drive: | 1Gb of free space |
| Graphics hardware: | Geforce 210 / AMD HD 5450 with 1GB RAM and DirectX 11.0 compatible |
| Sound hardware: | Integrated sound board |
| MS Kinect sensor: | Kinect for Windows TM |

The MS Kinect sensor must be bought with the cabling that allows connection to a PC through a USB port (as opposed to the MS Xbox video-game console). For avoiding any inconveniences on compatibility purchase always a "Kinect for Windows sensor" rather than "Kinect for Xbox 360".

## *Software requirements*

As indicated in section 1.1, the game was designed to work under computers with a Windows 7 or Windows 8 operating system. Windows 8 already comes with the latest version of DirectX 11 libraries required by the application. If using Windows 7, update the Operative System to the latest actualization through "Windows Update" utility:
- Go to "Control Panel".
- Select "System and security" option.
- Under "Windows Update", select "Search for updates" option.
- Press the "Search for updates" button.
- Once search is finished, accept updates installation.
- Once updated, Windows 7 will be compatible with any DirectX 11 application.

For installing the Microsoft Kinect sensor you need to download and install the Kinect SDK before connecting the device to the computer. Drivers can be found in the following webpage:
http://www.microsoft.com/en-us/download/details.aspx?id=40278

Make sure to download the Kinect for Windows SDK v1.8 for full compatibility with the application. Previous versions might give runtime errors.

Once the SDK is installed, plug the Microsoft Kinect sensor to the power source and the USB to a USB 2.0 or greater socket in your computer. Wait until all Kinect components are fully installed.
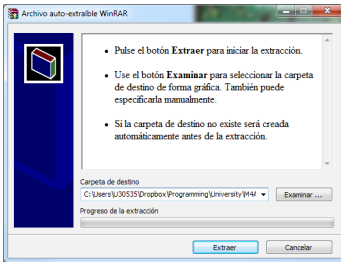
## Installation



To install the game in your computer you have to download the installer. When prompted, specify in which location you want the application to be installed.

The installer will uncompress all necessary files for running the application in the specified folder. Do not delete any of the uncompressed files.
All required libraries are integrated in the project and no further software installation is required after following steps descrived in section "Software requirements" and "Installation".

## Execution and main access

The game can be started by double clicking on the game icon that you may find in the folder where you installed the game. Once the application is open, you can go to screen selection where you can select any of the four game levels. After having selected the level, you have to select the profile/s you want to load or create a new one.

**First screen:**
Press START to play the game



**Second screen:**
Select the appropriate episode



**Third screen:**
Insert child's name (1st, 2nd and 3rd episodes) or children's names (4th epidode).

# USER MANUAL AND USE PLAN

# THE GAME

The game is designed to be used by the child accompanied by an adult (e.g. parent, caregiver, therapist, etc..). Its usage is designed according to a treatment plan defin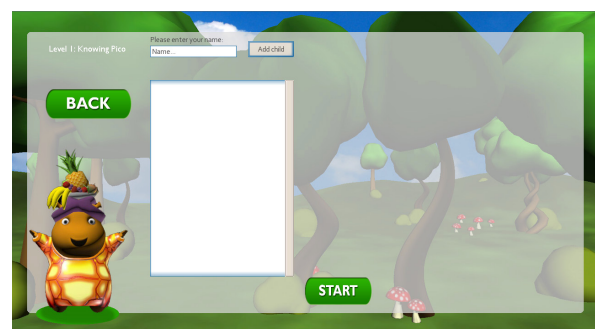ed by experts, which details both the appropriate conditions for usage and instructions for the accompanying adult. In the following sections we provide both general instructions about the structure of the game, general recommendations and specific instructions for each session.

## The Game

The game is based on the story of Pico, a friendly alien who landed on Earth due to a mishap with its spaceship. In its terrestrial descent Pico lands in the woods. At the beginning of the adventure Pico is a little bit shy of being in an unknown world and by the novelty of the environment. The child has to show Pico that they can be friends by helping it in some tasks, such as providing it with food or helping it fix its spaceship. To reward the child for his cooperation, Pico will give him different "super-powers" that will serve as tools to fulfill a number of tasks. Also, as a sign of gratitude Pico will invite the players to travel together to its planet. During the game, children - either alone or in collaboration with adults or peers - will have to help the character successfully achieve different missions. Each mission is designed to address a targeted behavior related to social initiation according to an increasing level in complexity.

## Structure of the game

The game is designed to follow a treatment plan based on four sessions aimed at providing a progressive scaffolding of social interaction skills defined by the experts.
Each session is represented by a different episode or mission in the game, following a progressive order. During each session different behaviors will be addressed and different social situations will be presented to the child. We recommend to play each episode on a different day to allow the child undertake the tasks in fresh and relaxed state of mind and avoid overwhelming the child.

## Episodes

Each episode corresponds to a different session of the treatment plan. Each one lasts from 15 to 30 minutes , depending on child's response. Instructions for playing each episode will be provided in section 3.3. Episodes are structured as shown in the following table:

| SESSION | EPISODE | SOCIAL SITUATION | PAGE |
|---|---|---|---|
| First session | "Knowing Pico" | The child plays in single-user mode | p. 13 |
| Second session | "Fixing the spaceship" | The child starts playing alone but at some point requires help from someone else; e.g. an adult such as a parent | p. 15 |
| Third session | "Arriving to the planet" | The child plays with an adult from the beginning of the session | p. 18 |
| Fourth session | "Receiving gifts" | The child plays together with another unknown ASD child | p. 20 |

## *General Recommendations*
- The game is designed to be played by a child accompanied by an adult. It is therefore recommended to supervise the child while playing this game.
- Each session should be presented to the child through a short introductory story aimed at explaining the goal of each episode. The adult should read the short story aloud to the child before starting the game.

### *Giving help to the child:*
- In case the child needs help, the adult can intervene following the next guidelines. We recommended not to provide immediate help to the child to observe whether he spontaneously requests this help, since this demanding behavior is one of the target skills in social initiation that the game wishes to foster.
- In case the child does not spontaneously ask for help, advice should be provided according to an increasing order of intensity. After providing a first small amount of help, the adult should wait for the response of the child. Only in the case in which the child does not respond, the adult may provide subsequent help.

> **Aids in increasing order of intensity:**
> 1. Verbal help: the adult provides verbal instructions to explain what the child should do.
> 2. Modelling help: the adult shows the child how to perform the action by acting out the target action
> 3. Physical help: the adult physically helps the child to perform the target action; for example, by placing the child's arm in a specific position.

### *Collaborative sessions:*
- In those sessions requiring the adult to play together with the child, the adult should remain passive, allowing the child to lead the game. In other words, the adult should act as if she did not know what to do and wait for the child's instructions.
- If the child remains passive or not know what to do next, the adult may propose simple hints and wait for the child to understand the situation and actions.

## How the child relates to the game

The technology we have used in the game (the Kinect sensor) captures the image of the child and places it inside the world of the game as shown in the figure below.



This behaves a bit like a digital mirror such that the child is reflected within the game environment and can hence interact with it. To achieve this, the child must stand at around 2 meters away from the screen and the Kinect sensor.

When the child appears in the game, he can move his arms and body freely. He can also walk laterally to the right and left in order to reach all the elements in the game.

**NOTE:** the child should not move toward or away from the screen because this would disrupt the correct interaction within the game.

By moving his arms, the child may reach out to the virtual objects in the game and generate actions that will have an impact in the game activity as explained below in the sections that describe each game session.

## Description of the sessions

In this section specific instructions for each session are provided. The instructions are organized as follows:
- in the first page of each episode are reported instructions for the caregiver
- in italics the story is provided in the format it must be read to the child before starting the session

# SESSIONS



Level 1: Knowing Pico

Level 2: Fixing the spaceship

Level 3: Arriving to the planet

Level 4: Receiving gifts

# SESSION 1: KNOWING PICO

## *INSTRUCTIONS*

### *How the game works*
**Note:** these instructions should not be read or explained to the child.
In this session the child gets to meet Pico, the main character of the story. Children can customize Pico in a number of ways to achieve a better empathy and adherence to the character. In order to change the appearance of Pico, the child must select one of the food items that appear in the tree tops of the forest where the action is set. Children must raise their hand and reach out for the the target food (as described in section 3.4) and keep the hand in that position for a couple of seconds until the food falls to the floor. At this point, Pico will see the food and move toward it, eat it and a magical change will be seen in its body.

The game is divided in four parts, each one changing a different aspect of Pico's body: (1) skin colour, (2) outfit, (3) hat and (4) complexion. After each part a set of images appear (as if they were old Polaroid photographs). The child must then select his favorite choice by raising his hand in front of the picture. This will fix that part of customization of Pico's appearance for the rest of the game. In the third and fourth parts of the game, a bird will appear every time the child makes a food item fall to the floor. The bird will stand on the food as if trying to capture it for itself. This impedes Pico to walk to the food item and eat it. The child should then scare the bird away by waving his arms in front of it. Once the bird flies away, Pico will be able to reach the food item and eat it.

### *Preparing the session*
* The child will play alone. He should stand in front of the screen and the Kinect sensor at an average distance of 2 meters in a space free of disturbing objects.
* The child should be introduced to the game by reading to him the short story "Knowing Pico"
* After reading the story you can start the game by pressing the button "Level 1: Knowing Pico"

### *During the game*
* In case the child does not play autonomously and needs help, an "owl sound" will indicate the appropriate moment to give help. Help should be provided in a scaffolding order (verbal, modelling, physical) as explained in section 3,3.
* In some situations the character will show specific facial expressions associated with basic emotions (e.g. happiness, sadness). Take advantage of these moments to ask the child how the character is feeling.

### *Useful keyboard commands*
If required the game can be remotely controlled by the adult using the keyboard. In the following table key commands for this level are described.

| 1-2-3-4 | Select foods or polaroids (from left to right) |
|---------|------------------------------------------------|
| Space   | Remove of the bird                             |
| S       | Greet the character                            |

### STORY: "Knowing Pico"

*Today you will play a game in which you will meet a very nice character. It is an alien that comes from another planet and its name is Pico.*
*Pico has come to Earth because its rocket broke down.*
*Pico is a bit shy but wants to be your friend.*

*You will see that in the game you will appear in the woods and after a while you will see Pico arrive and hide behind a tree.*
*If you give Pico the food that is hanging from the trees, it will come to you and become your friend.*
*You will also see that when Pico eats, funny changes will occur to it.*
*Once you give many kinds of food to Pico, you can move on to other adventures that you will play following days.*

# SESSION 2: FIXING THE SPACESHIP

## *INSTRUCTIONS*
### *How the game works*
**Note:** these instructions should not be read or explained to the child.

In this session the child helps Pico fix its spaceship and fuel it to be able to fly back to its home planet. The game is structured in two main parts. In the first part the child must find the pieces of the spaceship and collect them by raising his hand to reach for them and keeping the hand in this position for a couple of seconds. The pieces fall to the floor and then Pico takes them and mounts them on the spaceship structure.

Some pieces are too high for the child to reach, therefore he must ask for help to the adult (that means you or any other adult in the room). When the adult enters the play area s/he also appears in the game environment on the screen. The adult must have a passive attitude towards the game and must always wait for the child to provide instructions on which pieces the adult has to reach for.

Once the spaceship is fully reconstructed, the second part of this session starts. In this second part, the child must coordinate with the adult to catch falling stars needed to fuel the spaceship. To perform the action of catching the stars, the child must hold hands with the adult and make the stars fall between their arms. There are yellow stars which are good for the ship and red stars which are not good for it. Hence, the child has to discriminate between the stars that are useful for fueling the spaceship (yellow stars) and stars that are not useful for it (red stars).

### *Preparing the session*
*   The child will start the game by playing alone and standing in front of the screen at an average distance of 2 meters as in the previous session. This level is designed to elicit the child asking for help to the adult. For this purpose it is extremely important to position the kinect device with an inclination that allows to display the child image at half of the height the screen as shown in this figure.

- The child should be introduced to the game by reading to him the short story "Fixing the spaceship"
- After reading the story you can start the game by pressing the button "Level 2: Fixing the spaceship"

### *During the game*

- When the child asks for help, the adult should enter the play area and play the game according to the child's instructions. It is extremely important that the adult remains passive, allowing the child to lead the game.
- In some situations the character will show specific facial expressions associated with basic emotions (e.g. happiness, sadness). Take advantage of these moments to ask the child about how the character is feeling.

### *Useful keyboard commands*

If required the game can be remotely controlled by the adult using the keyboard. In the following table key commands for this level are described.

| 1-2-3-4-5-6-7-8-9 | Select spaceship's pieces(from left to right) |
| --- | --- |
| Space | Catch the stars |
| S | Greet the character |

## STORY "Fixing the spaceship"

*Do you remember that the other day you met Pico? That you gave it food and you became friends with it?*

*Today Pico needs help to fix its broken spaceship. All the pieces of the spaceship are scattered on the trees and you have to help it find them and gather them. This way Pico will be able to fix the spaceship and return to its planet.*

*You will see that now it is night time in the forest! Therefore it can be a bit difficult to see the pieces. However, Pico will give you a magic light to illuminate the trees and find the hidden pieces of the spaceship.*

*When you see one of the pieces, you must make it fall to the floor in a similar way to when you made the food fall to the floor. This way Pico will be able to collect them and place them in the spaceship structure. In case you cannot reach some of the pieces you can ask for help.*

*When you collect all the pieces and Pico has reconstructed the spaceship, you have to play with [Dad / Mom] to get some falling stars that give power to the spaceship.*

*When the spaceship has enough power it can then fly back to the planet of Pico.*

# SESSION 3: ARRIVING TO THE PLANET

## *INSTRUCTIONS*

⚠

### *How the game works*
**Note:** these instructions should not be read or explained to the child.

In this session the child and the adult travel to Pico's planet. The goal of this session is to liberate spaceships that belong to Pico's friends which are trapped in some strange evil clouds. In order to perform this action the child and the adult must collaborate. The child and the adult should point together to the spaceship using a "laser" that each one has in their right hand. The laser must be directed such that it remains on the cloud surrounding the spaceship until this cloud disappears. The child must give instructions to the adult on where to point and how. Furthermore, they need to match the color of the laser with the color of the cloud.

### *Preparing the session*
*   The child and the adult will play the game together from the start. Both should stand in front of the screen at an average distance of 2 meters
*   The child should be introduced to the game by reading to him the short story "Arriving to the planet"
*   After reading the story you can start the game by pressing the button "Level 3: Arriving to the planet"

### *During the game*
*   During the game the adult should remain passive, waiting for the instructions of the child on where and how to point.
*   In some situations the character will show specific facial expressions associated with basic emotions (e.g. happiness, sadness). Take advantage of these moments to ask the child how the character is feeling.

### *Useful keyboard commands*
If required the game can be remotely controlled by the adult using the keyboard. In the following table key commands for this level are described.

| Space | Remove the clouds |
|---|---|
| 1-2-3-4-5 | Remove specific clouds (from left to right) when multiple spaceships are presents |

### STORY: "Arriving to the planet"

*Do you remember that the other day we helped Pico to fix its spaceship? Now Pico invites you and [Mom / Dad] to visit its planet!*
*You will see that its planet is really nice, with beautiful bright colors!*
*But there is a problem in the planet. All the spaceships of Pico's friends in the planet are surrounded by a strange cloud that does not allow them fly properly.*
*You and [Mom / Dad] need to help them to free the spaceships to make them flying again! How can you free the spaceships?*
*Pico will give you and [Mom / Dad] a new super-power: a laser beam! To free the spaceships from the clouds you and [Mom / Dad] must point together to the clouds when they appear around a spaceship. This way the laser makes the cloud disappear and releases the spaceship.*
*Pico will be very happy if you help the spaceships of its planet!*

# SESSION 4: RECEIVING GIFTS

## *INSTRUCTIONS*

### *How the game works*
Note: these instructions should not be read or explained to the child.

In this session two ASD children play together. The goal of the session is to get some presents that the inhabitants of Pico's planet offer to them. These presents are to thank the children for having liberated the spaceships from the evil clouds in the previous session. The two children will again use a laser that appear on their right hands. They have to collaborate together by pointing their lasers toward the present boxes that appear in the buildings of Pico's planet. When the game starts, the customised Picos of each child appear on either side of the game environment and meet in the centre. After the children say hello to them with their hand, the two Pico's climb on a flying platform that is parked in the centre of the game area. If the two children jointly point at a present with their lasers, they correctly signal the flying platform to fly towards the present. Once the flying platform reaches the present, both Picos take it on board and fly back to where the children are. At this point the two children must touch the present with their right hand at the same time to open it. The present in the box then appears and a copy is given to each child.

### *Preparing the session*
- The two children will start together to play the game. Both should stand in front of the screen at an average distance of 2 meters
- The children should be introduced to the game by reading to them the short story "Receiving gifts"
- After reading the story you can start the game by pressing the button: "Level 4: Receiving gifts"

### *During the game*
- In some situations the character will show specific facial expressions associated with basic emotions (e.g. happiness, sadness). Take advantage of these moments to ask the child how the character is feeling.

### *Useful keyboard commands*
If required the game can be remotely controlled by the adult using the keyboard. In the following table keyboard command for this level are described.

| 1-2-3 | Direct the platform toward the gifts (1= red gift; 2= green gift; 3= blue gift) |
|-------|--------------------------------------------------------------------------------|
| Space | Open the gifts |

*STORY "Receiving gifts"*

*Today you will play together!*

*Do you remember that the last day you helped Pico free the spaceships of its planet from the strange clouds? Pico and his friends were really happy and grateful for your help and want to give you some presents today.*

*You will see that your Picos will appear together in the game and climb on a flying platform. You have to guide the flying platform to fly to the presents that appear from the windows of the buildings in the planet.*

*How you can do that? As the other day, today you will again have a laser beam coming out of your right hands. So you have to pay attention to the present boxes that appear and point your laser toward the present.*
*This way the two Picos will be able to fly to the present and take it back to you.*

*When the two Picos give you the present, you can open it to see the surprise inside!*
*To open the present remember you must both touch it at the same time with your right hand!*

# GENERAL SUMMARY

| | |
|---|---|
| **System requirements** | - Computer with Windows 7 o Windows 8<br>- Kinect<br>- TV Screen<br>- Keyboard and mouse |
| **Recommended age and population** | - Mid-high functioning children within the Autistic Spectrum Disorder<br>- 4 to 6 years old |
| **Game Duration** | 4 sessions (15-30 minutes each) |
| **Game Structure** | First session: the child plays alone<br>Second session: the child starts playing alone but at one point requires help from an adult; for example a parent or caregiver<br>Third session: the child plays with an adult from the start of the session<br>Fourth session: the child will play together with another unknown ASD child |