

POLITECNICO DI MILANO
School of Industrial and Information Engineering
Computer Science Master Degree
Advanced User Interfaces Course



Teo 2 (Emotional Teo)

Professor: Franca GARZOTTO
Tutor: Francesco CLASADONTE

Students:
Riccardo CAMPO
Moreno SARDELLA
Rafael RODRIGUEZ SANCHEZ

Academic Year 2016–2017

Abstract

Robotic companions have been proved effective to promote social skills. It is thought that this capability is enhanced when the robot exhibits some “emotional” behavior.

Contents

Introduction	1
1 Chapter 1	2
1.1 Users and needs	2
1.2 Goals of the system	2
1.3 Requirements of the system	2
1.3.1 Functional requirements	2
1.3.2 Non-functional requirements	3
2 Chapter 2	4
2.1 Games	4
2.1.1 Marco-Polo Game	4
2.1.1.1 Input	4
2.1.1.2 Goal	4
2.1.1.3 Rules	4
2.1.1.4 HW and SW requirements	5
2.1.2 Guide Blind-Teo Game	6
2.1.2.1 Input	6
2.1.2.2 Goal	6
2.1.2.3 Rules	6
2.1.2.4 HW and SW requirements	7
2.2 Interactions	7
2.2.1 Talk2Teo	7
2.2.1.1 Input	7
2.2.1.2 Goal	10
2.2.1.3 Activities	10
2.2.1.4 HW and SW requirements	10
Conclusions	11
Bibliography	12

A First appendix	13
-------------------------	-----------

List of Figures

2.1	Marco-Polo - 1st step	4
2.2	Marco-Polo - 2nd step	5
2.3	Marco-Polo - 3rd step	5
2.4	Guide Blind-Teo - 1st step	6
2.5	Guide Blind-Teo - 2nd step	6
2.6	Talk2Teo - configurations phase (1/2)	7
2.7	Talk2Teo - configurations phase (2/2)	8

List of Tables

1.1	Users and needs	2
2.1	HW and SW Marco-Polo requirements	5
2.2	HW and SW Guide Blind-Teo requirements	7
2.3	Talk2Teo Default preset configuration	8
2.4	Talk2Teo Greetings preset configuration	9
2.5	Talk2Teo More Emotion preset configuration	9
2.6	Talk2Teo actions	10
2.7	HW and SW Talk2Teo requirements	10

List of Algorithms

Introduction

The goal is to re-engineer and extend the existing version of Teo 2 with a Cognitive Module (enabling emotional sensing, expression features, adaptive Human-Robot Spatial Behavior and adaptive polite/intimate Behavior) and possibly evaluating the results against Teo 1.

The document is structured in this way:

- Chapter 1: it describes the users, their needs and the goals of the system
- Chapter 2: it describes some possible scenarios

Chapter 1

Chapter 1

1.1 Users and needs

User:	Needs:
School children/NDD-affected children	- Learn to recognize emotions from others - Interact socially with others - Convey emotional rewards to the children throughout learning activities
Special Teachers/Therapists	- Improve emotional growth of the children introducing robotics in the traditional therapy

Table 1.1: Primary users and their needs

1.2 Goals of the system

- Develop empathetic behaviors
- Include socially correct spatial management
- Produce emotional reactions that make Teo 2 more emotionally natural than Teo1

1.3 Requirements of the system

1.3.1 Functional requirements

- The user has to be able to talk with Teo
- The system has to understand the user mood
- The system has to be empathetic towards the users
- The system has to provide user statistics

1.3.2 Non-functional requirements

- Short response time
- Unharming materials
- Adequate battery autonomy

Chapter 2

Chapter 2

2.1 Games

2.1.1 Marco-Polo Game

2.1.1.1 Input

The therapist selects «Marco-Polo Game».

2.1.1.2 Goal

The goal of the game is to help the child to recognize spatial relations with Teo.

2.1.1.3 Rules

The child and Teo share sufficiently large space to move around.

The game starts with a 'blindfolded' Teo, which explains the child the dynamic of the game.

Teo prompts the kid to move away from him.

Anytime Teo needs help would ask 'Where are you, (name of the child)?' and the child must answer back 'Teo, here!'.

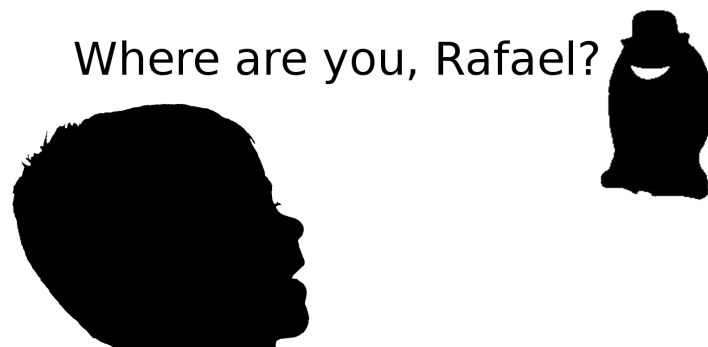


Figure 2.1: 1st step of Marco-Polo game

Teo will, then try to move towards the kid.

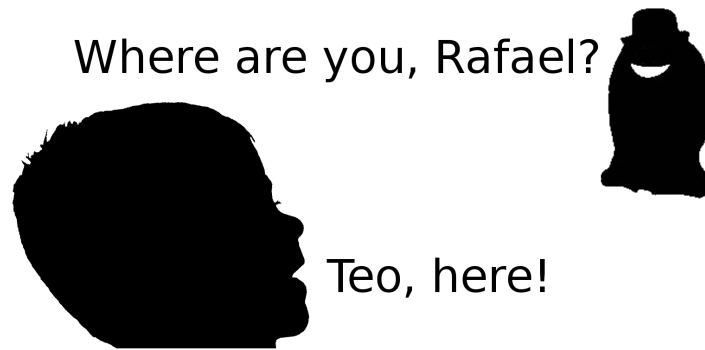


Figure 2.2: 2nd step of Marco-Polo game

If Teo is able to reach to the 'intimate region' with the kid for a moment, Teo wins and shows happiness congratulating the kid for helping him.



Figure 2.3: 3rd step of Marco-Polo game

Else, Teo keeps asking the kid for help and continues looking. The game ends when the child hugs Teo.

2.1.1.4 HW and SW requirements

Use:	Hardware:	Software:
Determine spatial orientation based upon the child's call	Microphones	Sound Localization
Verbal communication for the facilitator and rewarding roles	Speakers	Voice Synthesizer
Emotional rewarding	LED Matrix and strips	Emotional face generation
Measure the region of interaction between Teo and the child's	Distance/Motion sensors	Child's proximity and presence
To detect whether the child touch Teo to indicate he found him	Pressure sensors	Touch detection
Teo movement	Motors	Control

Table 2.1: HW and SW requirements of Marco-Polo game

2.1.2 Guide Blind-Teo Game

2.1.2.1 Input

The therapist selects «Guide Blind-Teo Game».

2.1.2.2 Goal

The goal of the game is to help the child to associate the sequence presented to a spatial relation with the physical checkpoints.

2.1.2.3 Rules

The child and Teo share sufficiently large space to move around.

The game starts with a 'blindfolded' Teo, which explains the child the dynamic of the game.

In a display it is shown to the kid a sequence of checkpoints that he has to help Teo to arrive while Teo's blindfolded.

The child must move to the check point and call 'Teo, here!' so Teo could start moving in his direction.



Figure 2.4: 1st step of Guide Blind-Teo game



Figure 2.5: 2nd step of Guide Blind-Teo game

Whenever Teo arrives to a correct checkpoint, congratulates the kid happily and prompts him to keep doing a great job.

The game ends when Teo reaches the final checkpoint.

2.1.2.4 HW and SW requirements

Use:	Hardware:	Software:
Determine spatial orientation based upon the child's call	Microphones	Sound Localization
Determine if Teo arrives to the right checkpoint	Kinect/RFID tags	Spatial Localization/Checkpoint ID
Display the sequence of checkpoints for the child to follow	Display	User interface to display information
Verbal communication for the facilitator and rewarding roles	Speakers	Voice Synthesizer
Emotional rewarding	LED Matrix and strips	Emotional face generation
Measure the region of interaction between Teo and the child's Teo movement	Distance/Motion sensors Motors	Child's proximity and presence Control

Table 2.2: HW and SW requirements of Guide Blind-Teo game

2.2 Interactions

2.2.1 Talk2Teo

2.2.1.1 Input

The therapist selects «Talk2Teo».

[optional]

The therapist can configure a joypad (which controls Teo) assigning an action to each button.

Figure 2.6: 1st step of Talk2Teo configuration phase

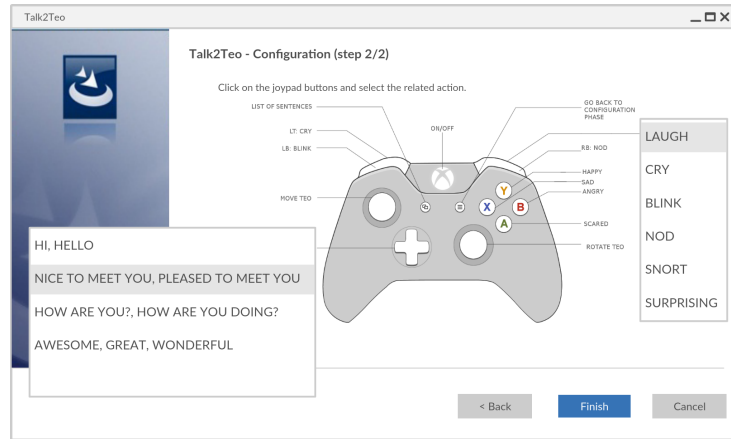


Figure 2.7: 2nd step of Talk2Teo configuration phase

In order to make things easy to use, there are the following presets of such configurations, so the therapist can choose what she prefers.

Default:	
Button:	Action:
X	Sad
Y	Happy
B	Scared
A	Angry
UP	"Hello"
DOWN	"Do you want to play?"
LEFT	«Great!»
RIGHT	"Well done"
ANALOG STICK 1	Move
ANALOG STICK 2	Rotate
LT	"Yes", Nod
LB	Laugh
RT	"No"
RB	Cry
START	Reset to idle
SELECT	Unassigned

Table 2.3: Manual joystick actions - More Emotion preset

Greetings:	
Button:	Action:
X	Sad
Y	Happy
B	Scared
A	Angry
UP	"Hello I'm Teo!"
DOWN	"What's your name?"
LEFT	"Nice to meet you!"
RIGHT	"Do you want to play?"
ANALOG STICK 1	Move
ANALOG STICK 2	Rotate
LT	"Yes", Nod
LB	Laugh
RT	"No"
RB	Cry
START	Reset to idle
SELECT	Unassigned

Table 2.4: Manual joypad actions - More Emotion preset

More Emotions:	
Button:	Configuration:
X	Sad
Y	Happy
B	Scared
A	Angry
UP	Surprised
DOWN	Bored
LEFT	*Sigh*
RIGHT	*Gasp*
ANALOG STICK 1	Move
ANALOG STICK 2	Rotate
LT	"Yes", Nod
LB	Laugh
RT	"No"
RB	Cry
START	Reset to idle
SELECT	Unassigned

Table 2.5: Manual joypad actions - More Emotion preset

If she skips this configuration phase, then the default preset will be associated to the joypad.

2.2.1.2 Goal

Talking to the user showing empathetic behaviours.

2.2.1.3 Activities

The therapist controls Teo using a joypad, allowing a *free2play* approach. The actions can be divided in manual and automatic ones (if both, the manual command have higher priority on an automatic reaction).

Manual:	Automatic:	Action:
x		Move/Rotate
x		Speak
x		Select mood (happy, sad, angry, scared)
x	x	Facial expressions (laugh, cry, ...)
	x	Non-linguistic utterances (yeah, ok, uh huh, mmmm)
	x	Follow (keep eye contact)

Table 2.6: Manual and automatic Talk2Teo actions

2.2.1.4 HW and SW requirements

Command:	Hardware:	Software:
Move/Rotate	Motors	Control
Speak	Speakers	Voice Synthesizer
Select mood (happy, sad, angry, scared)	LED Matrix and strips	Emotional face generation
Facial expressions (laugh, cry, ...)	LED Matrix and strips, speakers	Emotional face generation, voice synthesizer
Non-linguistic utterances (yeah, ok, uh huh, mmmm)	LED Matrix and strips, speakers	Emotional face generation, voice synthesizer
Follow (keep eye contact)	Distance/Motion sensors, RFID tags, motors	Control

Table 2.7: HW and SW requirements of Talk2Teo

Conclusions

Bibliography

Appendix A

First appendix