Supplementary Material

1 WIZARDING INTERFACE

1.1 Pre-Game Social Chat

Session 1

| Wake up robot | | Start | | Enable Questionnaire | | Q | **General responses:** |

Introduction:
Hi, I'm Neil. What's your name? | Awesome, nice to meet you

Playing the game together:
Excited playing the game | User: excited | User: Not excited | User: Undecided | Robot likes logic puzzles

Studying:
What do you study? | Sounds cool! | Robots likes Computer Science | Robot: Philosophy | Reason for philosophy

Where are you from:
Originally Uppsala? | Where are you from? | Local | Robot: Stockholm | Wow, that's quite far | Recommend in your country?
Around the corner | Go home often? | Robots: Going home | Favorit place in Uppsala? | Robot's favorite place

Weather:
How do you like Swedish weather? | I also don't like when it's so cold | I don't like winters here | I get sad when it's so cold
I love when it snows | I love summer in Sweden | It never gets too hot here | Last summer it was very hot

Sports:
Do you like to do sport? | Do you like to watch sport on tv? | Which sports do you like? | Skiing dangerous | Robot can't do sport
Robot like watching sport | Robot watches skking | Maike broke leg | Robot scared of skiing

Feelings:
I like when I can see new faces | Robot: very social | Students are interesting | Student's life is so exciting!

Geography:
How good are you in Geography? | User: Good | User: Bad

General responses:
Yes
No
I am not sure
Let me think about it
I'm very young
I'm almost four years old
I'm originally from Stockholm
My name is Neil
I am a Furhat robot
Sounds great
Sounds very interesting
I don't know what you are asking?
Sorry, I can't answer that question
I don't understand you
Oh really?
Too bad

Gaze:
Gaze down left
Gaze down right
Gaze up left
Gaze up right
Gaze away

Session 2

| Wake up robot | | Start | | Start the game | | Q | **General responses:** |

Previous Score: | Scoreboard: | Country: | Going home: | Study: | Geography:

Introduction:
Hi, nice to see you again | How are you? | Robot feels good | How is your week? | What did you do last week?
I was quite busy last week | I met a lot of students | No time to relax | Working extra hours

Valborg:
What did you do for? | Did you enjoy V? | Did you like it? | Boat race? | Robot couldn't go

First session:
It was fun | We scored %score% | It was quite a good score | We can do better | What do you think?
Say scoreboard | Remember countries? | Robot: remembers countries | Robot: say remembered | User: geo perception
However: Score high | Indeed: Score high | However: Score low | Indeed: Score low
That was pretty good | That is really amazing | Don't worry we can improve | Faster if location first | Don't say history of country

Home:
User: %going home% | Do you miss your family? | Do you miss being in %origin%? | What do you miss about it?
Do you have any siblings? | How old are they? | Robot misses home

Study:
Do you like studying %study% | Free time? | Dream job? | Robot: Would like to help people

Gaze:
Gaze down left | Gaze down right | Gaze up left | Gaze up right | Gaze away

General responses:
Yes
No
Remember my name?
Robot can't pronounce
I'm very young
Few people believe it
I look older
My name is Neil
I am a Furhat robot
I'm originally from Stockholm
Sounds great
Let me think about it
I am not sure
Sounds very interesting
I don't know what you are asking?
Sorry, I can't answer that question
I don't understand you
Oh really?
Too bad

Session 3

Wake up robot	Start	Start the game	Q

Score Session 1:   Score Session 2:   Total Score: NaN

Introduction:

| Hi there | How are you? | I'm fine, thanks. | Looks like this is already the last time we're meeting. At least for now. |

Last week:

| What have you been up to lately? | Some students from a high school came... | They wanted to know... | They think I can... |
| Good idea? | Could I help? | What can I be used for? | Great to work in schools |

First session:

I can't wait to start	We scored %score%	In total, we scored %score_total%	We need %difference% to become the best overall team
Hard to accomplish	That seems doable	We can make it in the top 10	We can still score quite well
It's a very good progression	Let's keep up with the good work	Let's try to do better this time	I think we can do even better this time
Enough experience to improve	Remember countries?	Robot: remembers countries	Hard to pronounce	Viet Nam

Competitive:

| Are you a competitive person? | That explains a lot | Robot is competitive |

Weather:

| It was very rainy last week | Spring has not arrived | Summer hasn't arrived | Summer is there | Finally nicer |

Gaze:

| Gaze down left | Gaze down right | Gaze up left | Gaze up right | Gaze away |

General responses:

| Yes |
| No |
| Remember my name? |
| Robot can't pronounce |
| I'm very young |
| Few people believe it |
| I look older |
| My name is Neil |
| I am a Furhat robot |
| I'm originally from Stockholm |
| Sounds great |
| Nice |
| Let me think about it |
| I am not sure |
| Sounds very interesting |
| Sorry, I can't answer that question |
| I don't understand you |
| Oh really? |
| Too bad |
| Thanks |

1.2 Game Interface

Points
0

Time

Enable Game	G

Countries correctly identified:

Countries the agent knows about:

- America
  - Brazil
  - Canada
  - Mexico
  - United States
- Asia
  - China
  - India
  - Russia
- Australia
- Europe
  - Italy
  - Sweden
  - France

Countries Remembered: **Countries Forgotten:**

Questions:

So which one is it?	What does it look like?	Location?	What's the name?
Which continent?	East or west?	North or south?	Where exactly?
Is it next to the ocean?	Which does it border?	What's the shape?

Moving on

| Last chance - move on | Let's move on | Request next target | Click next question |

(Not) scoring points

| Oh (negative) | Sorry | Nice! | Yay |

Not identified:

| Don't know where | I still can't identify it | I need more information | Continue describing |

Remembering:

| Robot remembers | I don't remember that one | Robot does not remember |

Question Responses:

| Yes | Okay | No | Mh |

Furhat expression:

| Smile | Frown |

Furhat Gaze:

| User | Map |

Off Topic:

| Not sure what you're talking about | Let's get back to the game | I don't understand you |

Furhat Gaze (Map):

| N. America | S. America | Europe | Africa | Asia | Australia |

1.3   Post-Game Social Chat

Session 1

Wake up robot	Start	Enable Questionnaire	Q

Countries correctly identified:

Game Performance:

Good performance (15+)	Okay performance (10-15)	Bad performance (0-10)

Are you satisfied?	How do you think we could improve?	Is there anything we can do better next time?

Fun:

Anyway, I think it was pretty fun.	Glad to hear you had fun, too	Oh really? Sorry to hear that.	Why did you not like it?

What did you like about it?	Do you think you learned something?	Will you remember?	I hope I will...

Travelling:

Have you been?	Which one?	Tell me more about it.	Is it hot there?	Is it cold there?

What did you do there?	Did you like it?	What did you like about it?	What did you do during the day?

Where else have you been?	What did you eat there?	Robot wants to try food	Wearing a hat

Robot: France	Airport Inspection	Maike - Nepal	Natalia - Colombia	Giulia - Italy	Sebastian - Portugal

General responses:

Yes
No
I agree
Good point
Interesting. I'll think about it.
Nice
That sounds amazing
I would love to see it
No I haven't
No I didn't
What do you mean?
Thanks

Gaze:

Gaze down left
Gaze down right
Gaze up left
Gaze up right
Gaze away

Session 2

Wake up robot	Start	Enable Questionnaire	Q

Score: 0   **Previous Score:**   **Scoreboard:**   **Country:**   **Capital:**   **Travelled:**

Game Performance:

We scored %score%	Say scoreboard	Next session will be better	That is amazing	How can we repeat that?

Good performance (15+)	Okay performance (10-15)	Bad performance (0-10)	Performance: Better	Performance: Same	Performance: Worse

Are you satisfied?	How do you think we could still improve?	Is there anything we can do better next time?	I should study geography more

Do you think our strategy was better this time?	Did you feel it was easier this time?	I think it was easier after we got a bit of practice.

Fun:

I personally had even more fun this time	Glad to hear that	Oh really? Sorry to hear that.	Why did you not like it?

What did you like about it?	Will you remember more?	I'm sure next time I will remember more.

Travelling:

You have been to %travelled%	Which countries would you like to visit in the future?	Is it hot there?	Is it cold there?

Why would you like to go there?	What would you like to see there?	You said you are from %origin%	Robot looked at google

Have you ever been to %capital_origin%?	Food you miss?	Giulia: Pizza and Pasta	Natalia: Empanadas

Robot: Japan	Robot Germany

General responses:

Yes
No
I agree
Good point
Interesting. I'll think about it.
Nice
That sounds amazing
I would love to see it
No I haven't
No I didn't
What do you mean?
Thanks

Gaze:

Gaze down left
Gaze down right
Gaze up left
Gaze up right
Gaze away

Session 3

Wake up robot		Start		Enable Questionnaire	Q	**General responses:**

Score: 0   Scoreboard: Score Session 1/2: /   Total Score: NaN   Travel: Origin:

Game Performance:

That was an awesome last round!	I think this last round was quite okay.	Well… you can't always win, I guess	Say highscore
This game we scored %points%	This makes a total of %score_total%	Say scoreboard	Satisfied?
At least we got better over time!	We got so much better over time	It's just too bad we don't have another chance	
This game was just the exception	Overall, this was our best performance!	We improved a lot	Most important thing is taking part

General responses column:
- Yes
- No
- I agree
- Good point
- Interesting. I'll think about it.
- Nice
- That sounds amazing
- I would love to see it
- No I haven't
- No I didn't
- What do you mean?
- Thanks

Robot remembers:

I think I will continue studying	But I surely learned something	In Asia	Next to India	In Europe	South of France
In South America	Right were central and south America meet	In Africa	On the very East coast		Right above Australia
Under Sweden	At the border of Europe and Africa	Right above Brazil			

Fun:

I had a lot of fun playing with you	Last meeting :-(	Meet again?	What would you like to play?	Tower of Hanoi

Gaze:
- Gaze down left
- Gaze down right
- Gaze up left
- Gaze up right
- Gaze away

Improve interacting:

What can I do better in the future?	I try my best	What can I improve?	Working on personality

Future travel:

You would travel to %future travel%	Why?	What to see there?	Cities or nature?	Robot not outdoor

World news:

Are you following the world news a bit?	Great Britain	Worried about Brexit	Brexit?	Venezuela?	So much happening

Exams:

Do you have a lot of exams coming up?	Good luck	Ah that's nice then you can relax
Alright, it is time to say goodbye	It was a real pleasure to play with you	Learn more about home country

2 WIZARDING GUIDELINES

2.1 RDG-Map Game Interaction

2.1.1 Verbal Reactions

Countries

The target countries for each session are enlisted in Table S1.

In Session 1, the robot is able to identify by name only the countries in Table S2. For all the other countries, it needs the verbal description of the interaction partner.

In Session 2 and 3, the robot remembers a few countries that were correctly identified in session 1. These countries are provided in the wizarding interface.

Within the same game interaction, the robot remembers the target countries that it has correctly guessed (i.e., for which it scored points). These are automatically added to the wizarding interface. In addition, it remembers the countries whose name was explicitly mentioned in the interaction and whose location was explained (e.g., in reference to another country).

If the human interaction partner (i.e., the director) names a country that the robot does not know, the robot always responds with "I don't know where that is".

Continents

The agent can identify continents and broad geographic areas like "East Africa" or "Middle East" by name.

Bodies of Water

The robot can also identify the Pacific, Atlantic and Indian Ocean by name. Other bodies of water can be identified as such, but the robot does not know their name. It can however learn the names of the different bodies of water is explicitly taught by the human interaction partner.

Table S1. Target countries per session

Session 1	Session 2	Session 3
Indonesia	Mexico	Laos
Pakistan	Somalia	Greece
Italy	Vietnam	Great Britain
Lybia	Turkey	Nepal
Bolivia	Colombia	Cameroon
Nepal	Greece	Vietnam
Colombia	Papua New Guinea	Portugal
Portugal	Paraguay	South Korea
Somalia	Germany	Ukraine
Papua New Guinea	Nepal	Germany
Zambia	Angola	Indonesia
Kazakhstan	Venezuela	Turkey
Finland	Algeria	Haiti
Japan	Spain	Chad
Nigeria	Yemen	Suriname
Iraq	Cuba	Hungary
Iran	Estonia	Sudan
Syria	Thailand	Argentina
Ireland	Kyrgyzstan	Cambodia
Serbia	Croatia	Dem. Rep. of Congo
Bulgaria	Afghanistan	Poland
Madagascar	Niger	Bangladesh
Ethiopia	Chile	Benin
Canada	Chad	Tanzania
Argentina	Philippines	Norway
Slovakia	Togo	Iceland
Poland	Panama	Ivory Coast
Benin	Jordan	Ireland
Tanzania	Mongolia	Canada
	Madagascar	Madagascar
	Korea	Gabon
	Dominican Republic	Tunisia
	Eritrea	Jordan
	Taiwan	Lesotho
	Arab Emirates	Bhutan
	Swaziland	Uruguay
	Denmark	Guinea
	Slowakia	Malaysia
	New Zealand	Senegal
	Tunisia	Honduras
		Macedonia
		Togo

Landmarks

The robot does not know the name and location of specific landmarks in the world. However, it can learn the name of a landmark if explicitly taught by the human director.

Relational Information

The robot can determine the following relational information between countries, continents, landmarks and bodies of water:

- *Cardinal directions*: north, south, east, west

Table S2. Countries that the robot is able to identify by name.

America	Asia	Europe	Oceania
Canada	Russia	Sweden	Australia
United States	China	France	
Mexico	India	Italy	
Brazil			

- *Egocentric directions*: left, right, below, above, up, down, bottom, top, lower, higher

Egocentric directions are interpreted from the director's perspective (from the point of view of the human partner). The agent can count and determine relational information like "two countries above".

Shapes and Sizes

The robot can generally identify the shape of a country and make associations to shapes of commonly known objects like animals, plants or household objects. It is the wizard who estimates whether a shape description given by the human partner fits a country.

The robot can interpret size descriptions in relation to the surrounding countries in the same region. For instance, if a country is described as small, the robot can only evaluate if it is smaller than the average country in the surrounding area.

Asking Questions

The robot can ask several questions to identify a country. However, tt only asks questions after the director (i.e., the human partner) has given an initial description of the country. Questions are used if there is only one particular information that distinguishes two otherwise equally likely countries, or if the director has not provided any clue that could help the robot in identifying the target country. The agent can select from the following list of questions:

- **Shape:** To inquire about the shape of the country, the agent asks "What does it look like?" or "What is the shape of the country?". The first alternative is preferred and only exchanged if the director misinterprets the question.
- **Location:** To get some more information about the location of the country, the robot asks: "Can you say more about the location?", "Is it next to the ocean?" or "Which countries does it border?". The latter one is only used if the agent suspects it knows one of the neighboring countries by name.
- **Name:** In case the agent suspects it already knows the name of the target country, it can ask: "What's the name?"
- **Continent:** The agent can inquire which continent a country is in by asking: "Which continent?"
- **Clarifications:** To clarify something the director has said, the agent can ask: "East or west?" or "North or south?" or "Where exactly?". These are typically used when the location description in relation to a country or continent given by the director was under-specified.

In addition to the specific questions, the robot can also make use of three generic phrases to get the director to provide further descriptions: "I still can't identify it", "I need more information" and "Continue describing".

Answering Questions

The robot can answer simple yes / no questions, for instance: "Do you know where Syria is?". The agent can also answer generic questions about the game rules, e.g., whether the director can say the countries name ("Can I just say the name?"). If the question does not fall in one of these two categories, the agent responds: "I'm not sure what you're talking about", or "I don't understand you".

Skipping

The robot does not ask to skip a country. If the director asks if it is okay to skip a country the agent makes the most educated guess it can make at that point in order to try to score points if possible.

Backchannels

If the robot understood a previous cue and a short pause in the director's speech is detected, it acknowledges the understanding saying: "Okay." This acknowledgement can be followed directly by a question. If the agent cannot determine the referent of a description, it can utter: "Mh", which can be followed by a question again.

Reacting to Pauses

In the very beginning of the game, if the director does not start describing the target country within 30 seconds (the typical loading time of the iPad was about 20 seconds), the robot says: "So which one is it?" The same question is asked if the director requested a new target and did not give a single description for five seconds. If pauses longer than 5 seconds occur within a block of descriptive cues, the agent can either utilize the backchannel: "Mh" or ask a question to get the conversation going again. If the pause persists and the director is not reactive to the agent's question, the agent can direct the gaze towards the user for a period of about two seconds, before directing it back to the map.

Off-topic Talk

If the director talks about something the robot does not understand or tries to engage the robot in a topic outside the scope of the game, the agent says: "Let's get back to the game" or "I'm not sure what you're talking about."

Moving On

In case the robot has already made two guesses and has hence no additional guesses left, it can inform the director about this by saying: "This was our last chance. We have to move on". In case the director does not request the next target country, the agent can say: "Let's move on", "Request the next target" or "Just click on the next question button." The latter can also be used if the director raises the question whether or how to move forward after the agent made a correct selection.

Reactions to Scoring and Not Scoring Points

If the robot's selection was correct, the agent randomly picks between saying: "Nice!" and "Yay!" In case a selection was wrong, the agent can respond with: "Sorry" and "Oh". In both cases, the agent gives such a verbal reaction only occasionally.

Remembering

In the second and third session, if the director mentions a country that was identified in one of the previous sessions and that the robot remembers, the robot says: "I remember this country." In case the country was part of a previous round, but the robot does not remember where this country is located, it says: "I don't remember that one."

2.1.2   Country Selection

If the information provided by the Director are sufficient to identify the country (e.g., the combination of cues given has a high probability to belong to exactly one country on the world map), the wizard selects the corresponding country on the world map. The agent then automatically says "Got it!" or, in case this was the second guess, "Oh, I see, I got it".

In case the information given is not sufficient, an extended amount of time has already elapsed, and multiple questions by the agent did not lead to a high enough probability that one country is correct, the wizard selects a random country from the set of possible ones given the current description.

If the director does not move on after the agent identified the correct target country and takes a break of at least 2 seconds in descriptions, the agent says: "I got it. Just move on".

2.1.3   Gaze

By default, during the game interaction, Furhat's gaze is directed towards the center of the map. Whenever the director mentions a known country, region or continent on the world map, the agent directs its gaze towards that part of the world. The gaze then stays at that location until the next known region is mentioned. In case of long pauses by the director or in case the director does not react to questions, the robot directs its gaze towards the director for about two seconds, before directing it back to the center of the map.

2.2   Social Chat

2.2.1   Verbal Reactions

The agent starts the different topics by following the wizarding interface from the top to the bottom (see Section 1.1). The left-most button always represents the opening sentence said by the agent to start a topic. The button is followed by one or several follow-up questions or responses to potential replies from the human interaction partner. The buttons to prompt the follow-up questions and responses of the robot are located to the right of the last response button.

There are a few generic questions the agent can answer independent of the current topic. Whenever one of the generic responses to the right fits a question, the agent will answer it. Otherwise, it will say: "I don't know what you are asking", "Sorry, I can't answer that question" or "I don't understand you".

2.2.2   Gaze

When the user asks a question to the robot, the robot can direct its gaze towards the bottom left or bottom right to give the impression of thinking about the question. This is only used seldom (maximum of twice per session and social chat interaction), never used for two questions in a row, and preferably used for questions that require some reflection process (e.g., not if the human partner asks the robot how it feels).