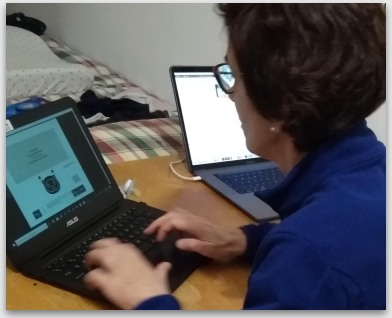
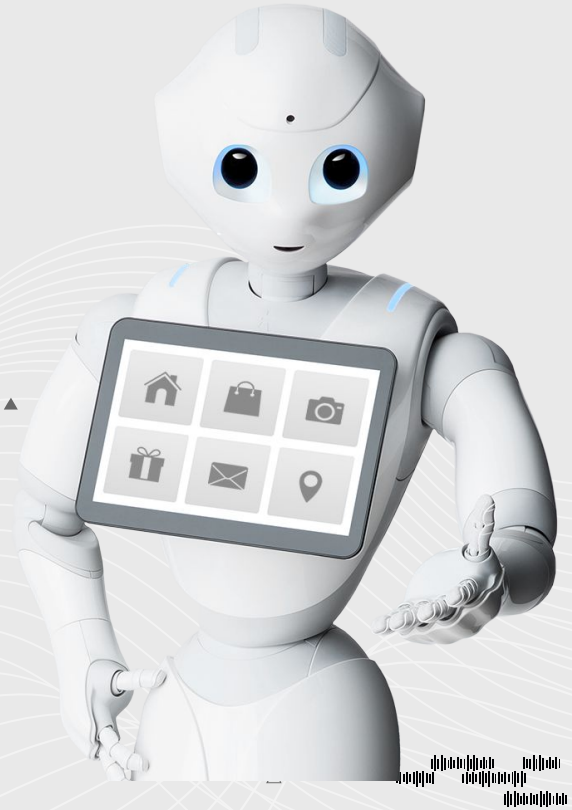


Language Learning Robot

Cognitive Interaction with Robotics
Course Project 2020-21

Introduction

- Learning is a challenging and often boring task.
- How can the interaction between an AI and user be an asset to make a better learning experience ?
- Develop a proof-of-concept robotic language teaching system.
- Evaluate what makes Human-Robot-Interaction engaging.



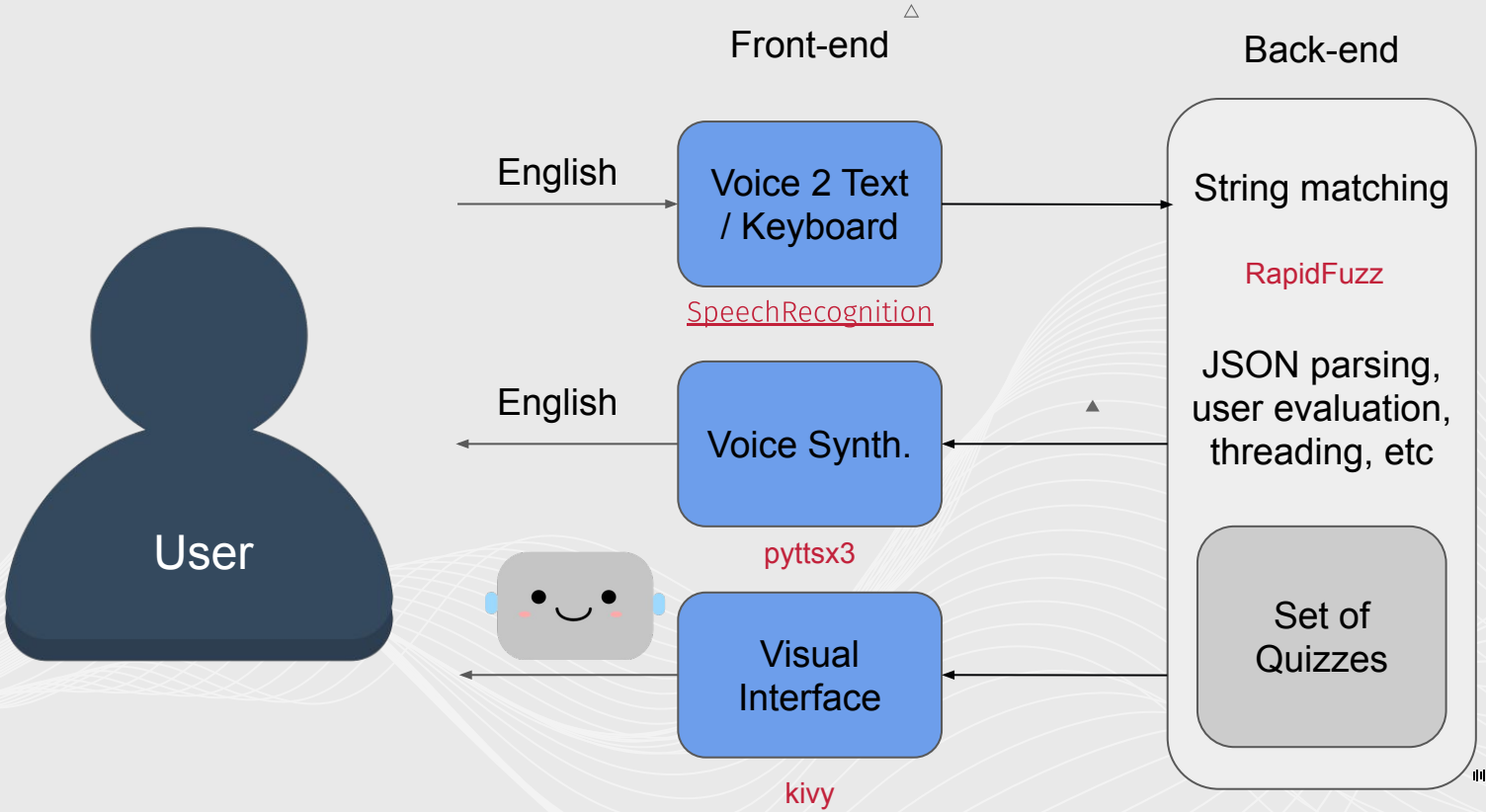
Hypotheses

I. Do users prefer to learn a language using voice interfaces over keyboard interfaces?

II. The older the user is, the more important vocal interaction is when using technology.

III. If the robot shows emotion, the experience becomes more enjoyable.

Software System Overview



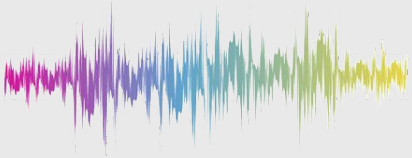
Voice Recognition and Answer Matching

1. Ask question verbally

"Do we know what happened to Nancy yesterday?"

Pyttsx3

2. Microphone input processing



"She said felt passed”

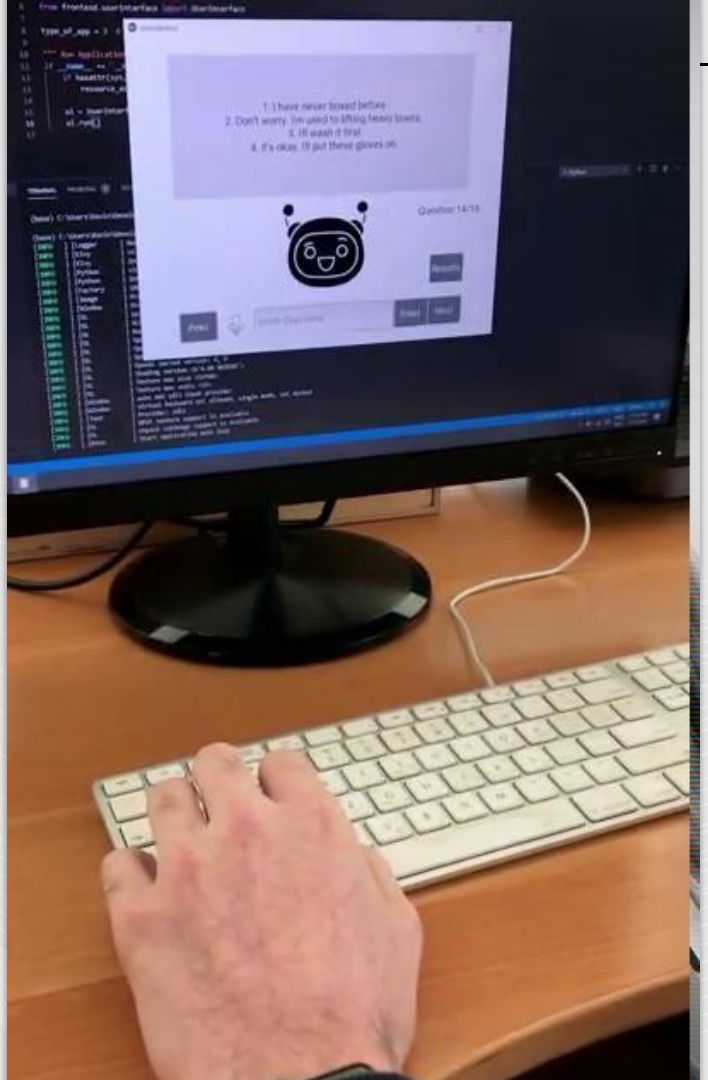
SpeechRecognition
Google Web Speech API based on LSTM NN

3. String matching

		P(x)
1.	"She wrote down a list of instructions.",	**0.1**
2.	"They say she retired last week.",	**0.3**
3.	"She said she felt a pain in her chest, then passed out.",	**0.5**
4.	"I will see her tomorrow."	**0.1**

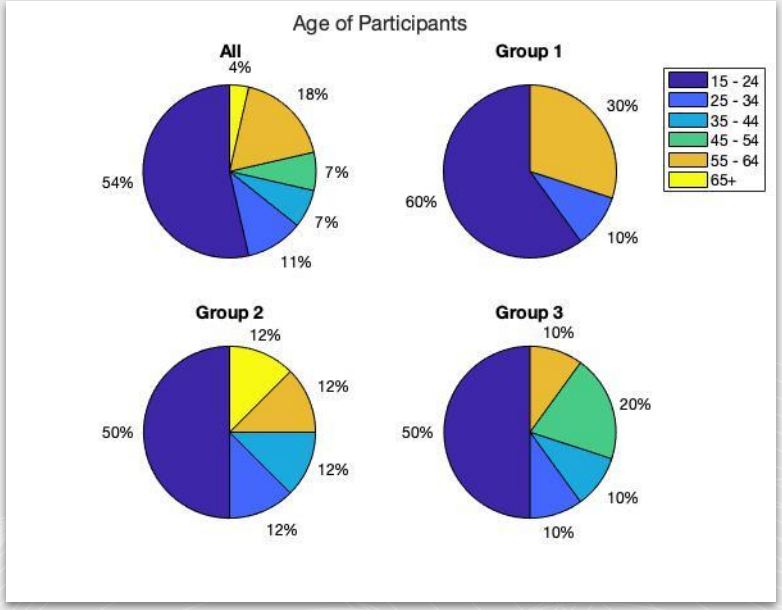
RapidFuzz based on Levenshtein distance

Demo


1. I have never boxed before.
2. Don't worry. I'm used to lifting heavy boxes.
3. I'll wash it first.
4. It's okay. I'll put these gloves on.

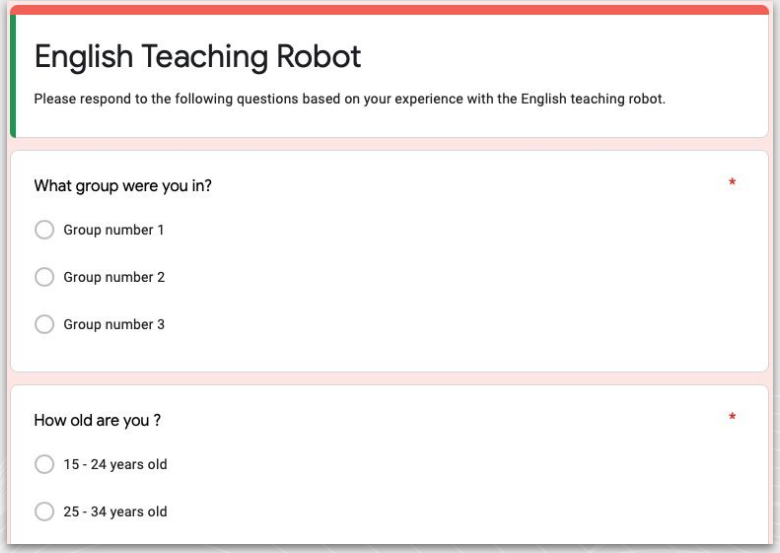
Experiment

- 3 Groups of ca. 10 participants each
  - Speech input only (Gr. 1)
  - Keyboard input only (Gr. 2)
  - Both input methods (Gr. 3)
- Ages distributed across groups
- 11 Female, 17 Male
- Complete 15 oral comprehension questions with robot
- Complete Questionnaire



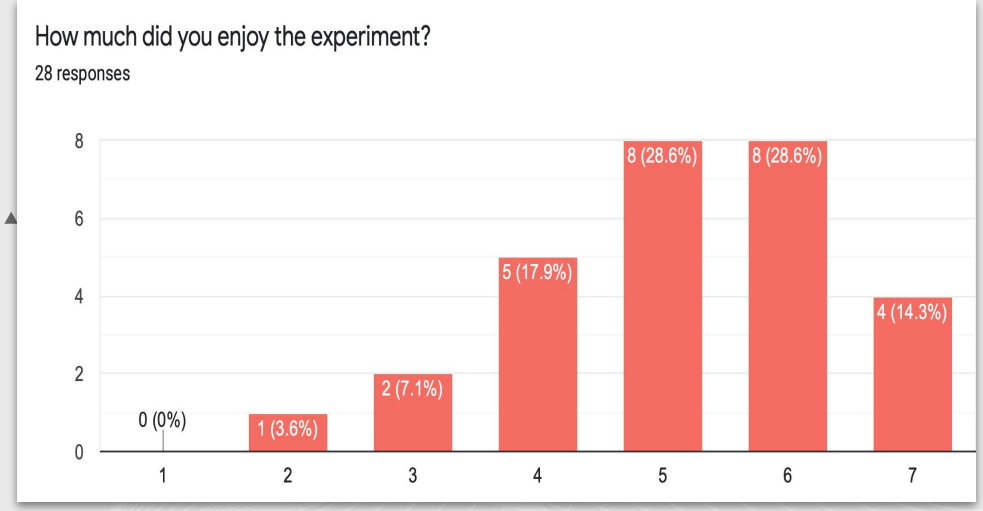
Questionnaire

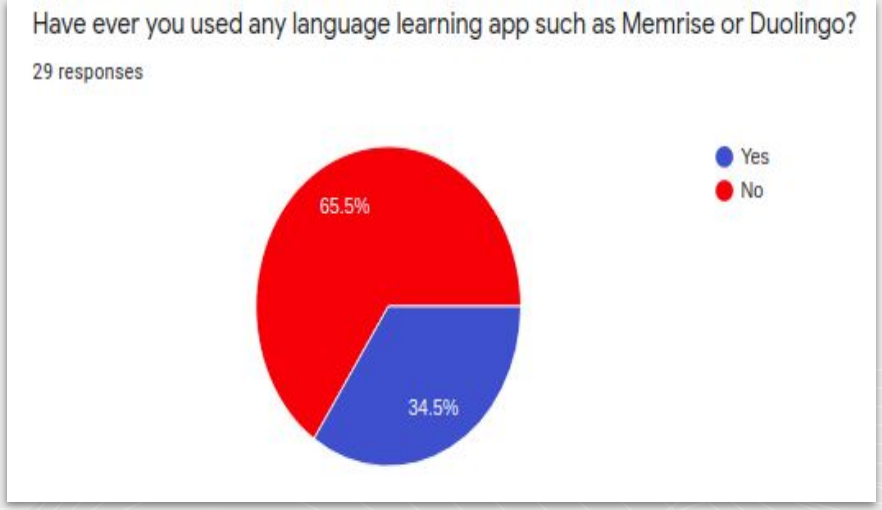
- Questionnaire based on [1, 2]
  - 4 questions about participants
  - 11 questions for hypotheses
  - 3 free text responses
- Google Forms
  - Link provided by robot upon completion
- Statistical Evaluation in Matlab / Python



1. Short, E. et al. No Fair!!An Interaction with a Cheating Robot
2. Bainbridge et al. The effect on presence on human-Robot interaction

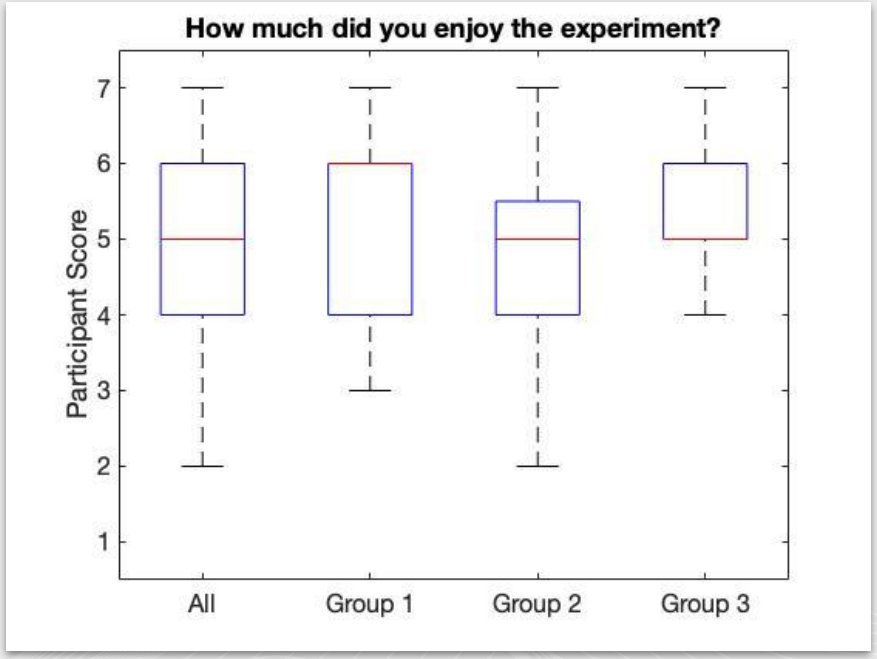
General Information





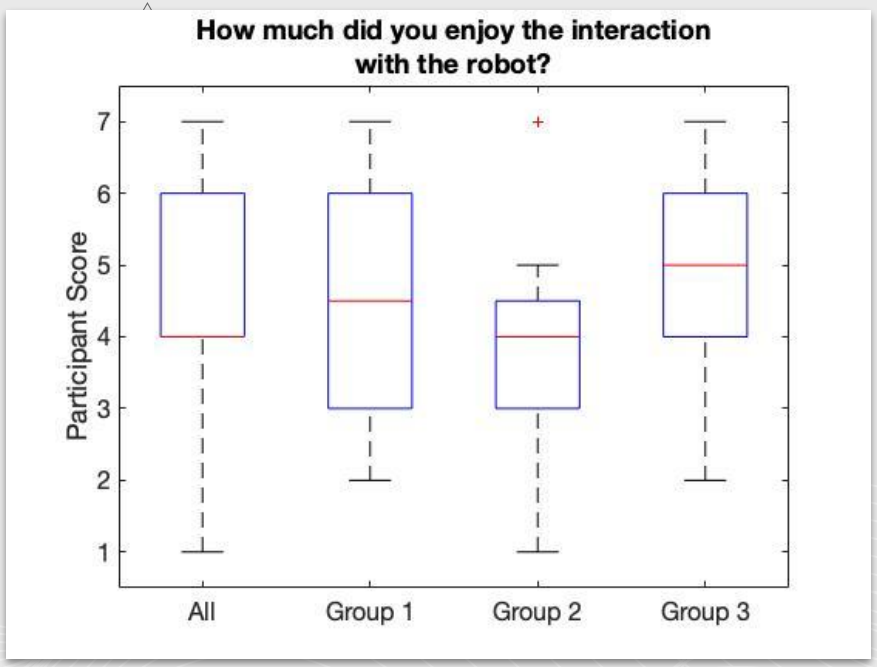
Evaluation Hypothesis 1

"Do users prefer to learn a language using voice interfaces over keyboard interfaces?"



Mean:	5.143	5.2	4.75	5.4

t value: 0.660; p value: 0.259 !

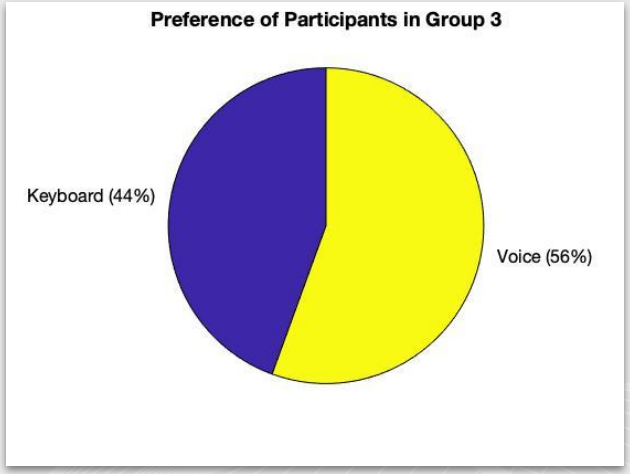


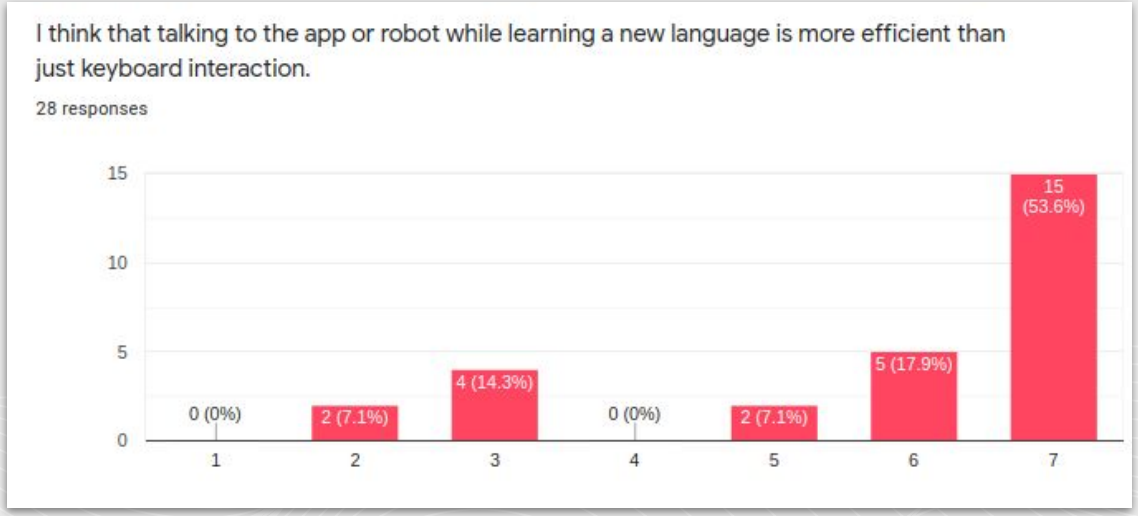
Mean:	4.429	4.5	3.875	4.8

t value: 0.735; p value: 0.236 !

Evaluation Hypothesis 1

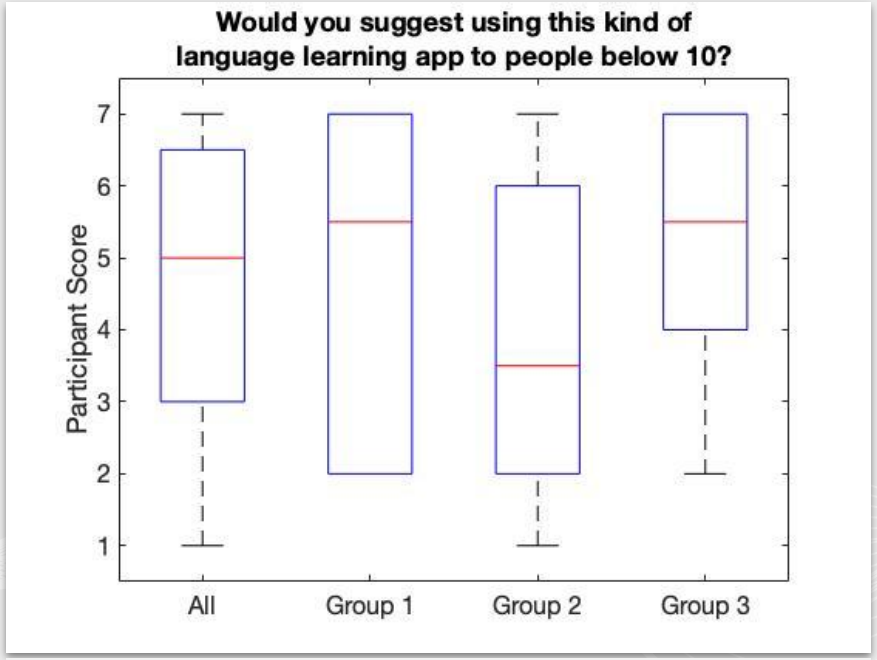
"Do users prefer to learn a language using voice interfaces over keyboard interfaces?"



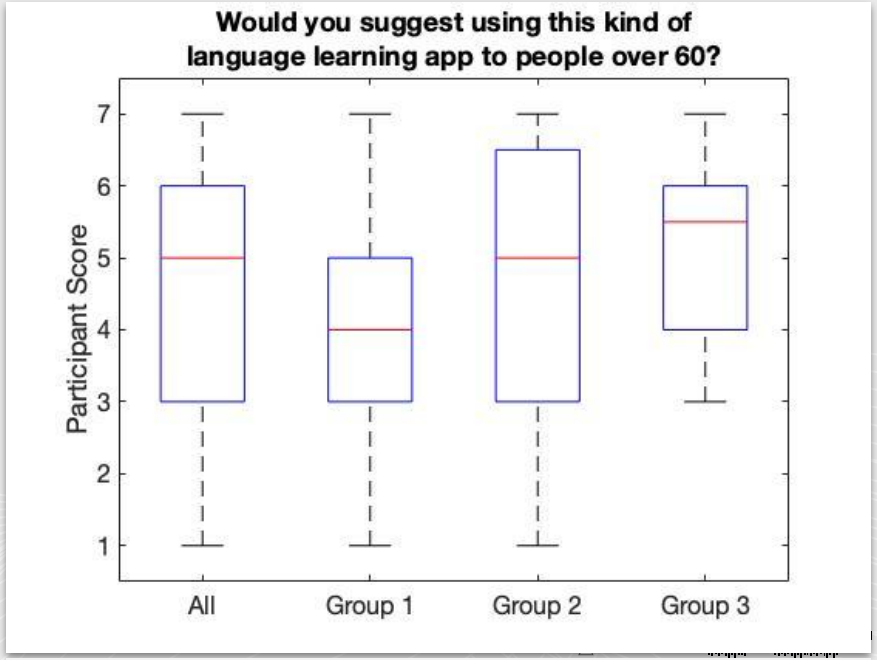


Evaluation Hypothesis 2

"The older the user is, the more important vocal interaction is when using technology."



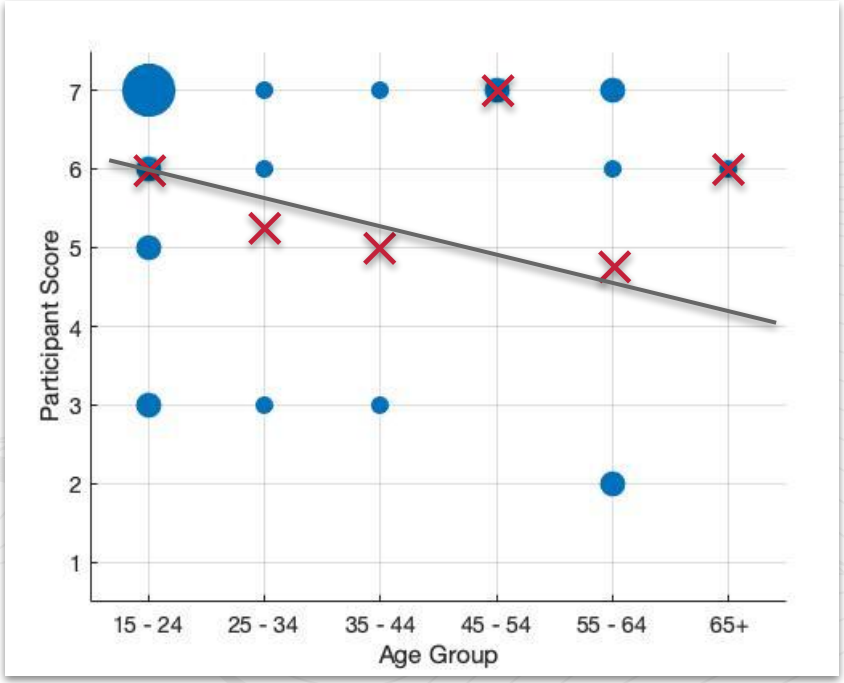
Mean:	4.6071	4	4.625	5.2



Mean:	4.6786	4.8	3.875	5.2

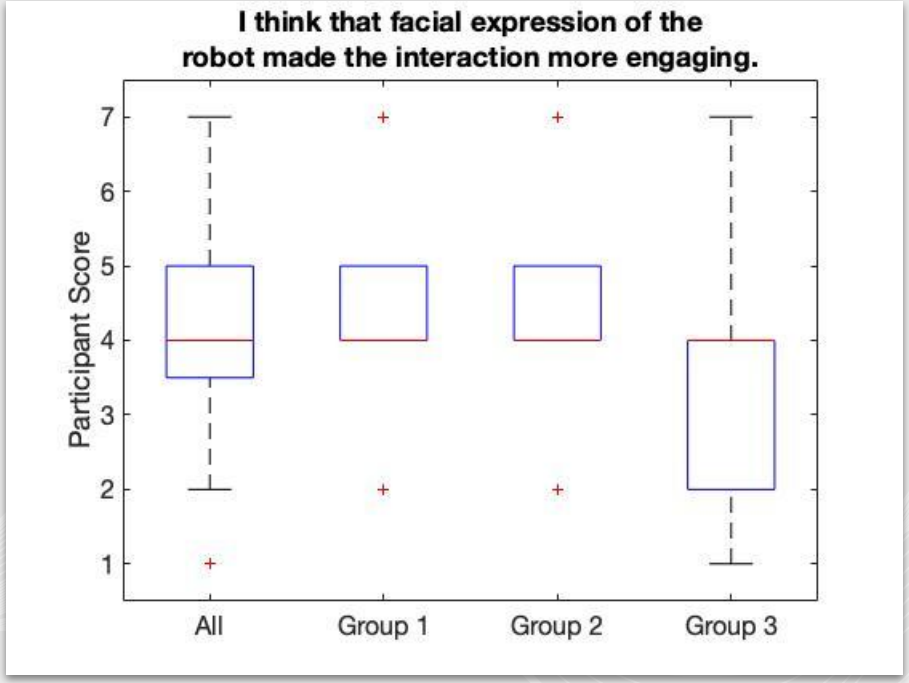
Evaluation Hypothesis 2

"I think that **talking to the app** or robot while learning a new language is more efficient than just keyboard interaction."



Evaluation Hypothesis 3

"If the robot shows emotion, the experience becomes more enjoyable."



- ➔ Many users did not notice any robot expressions
- ➔ We cannot answer this hypothesis, due to lack of data

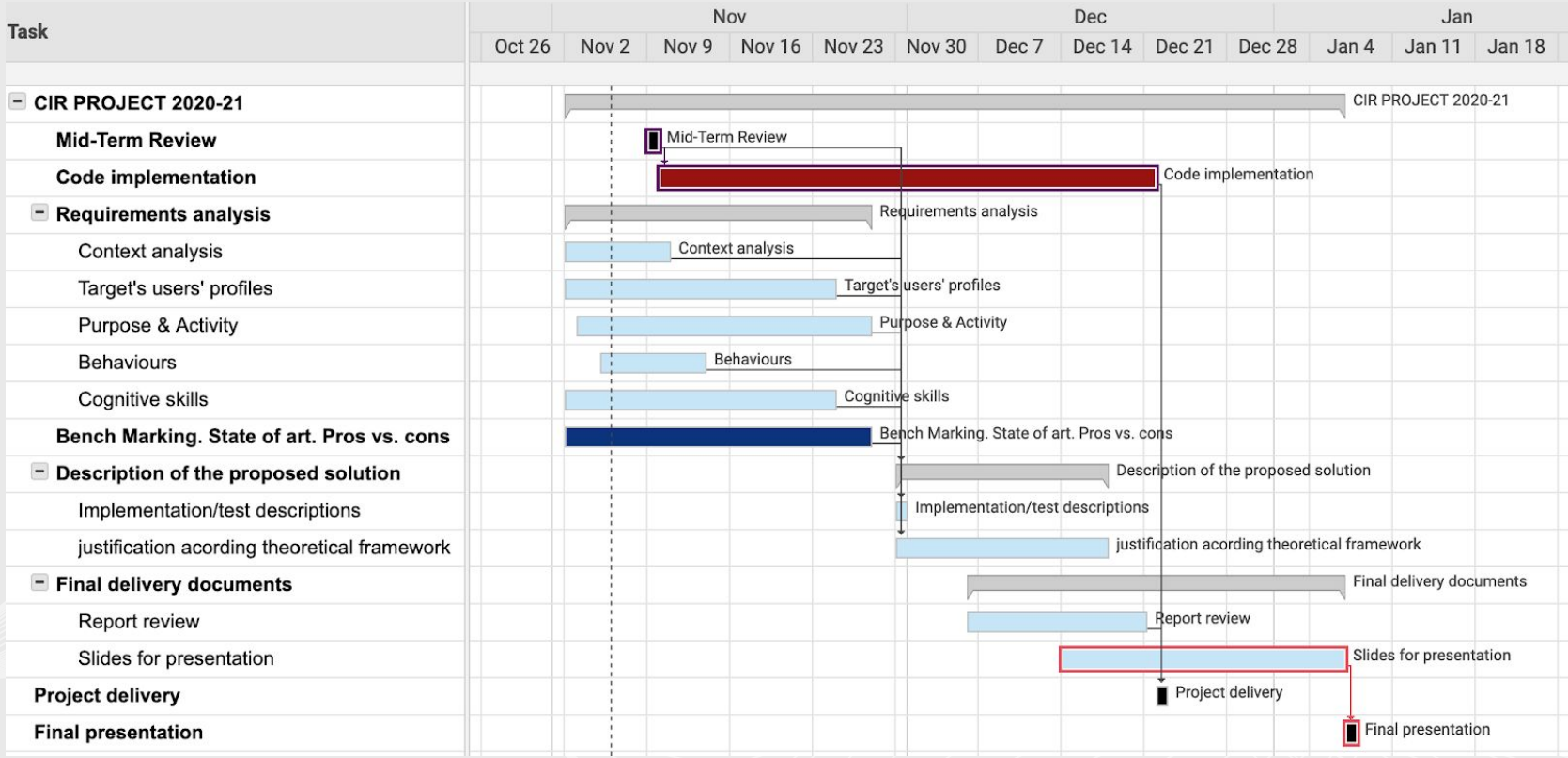
Lessons Learned

- Software Development is very hard
  - You can never do enough debugging
  - Writing the app is just part of the job, another thing is to properly deploy it
- “Anything that can go wrong will go wrong” - Murphy’s Law
  - More instructions (e.g. user shouldn’t answer with number)
- Adjust speaking speed & question difficulty automatically
  - “Questions too hard for inexperienced English users”
  - “Robot should speak slower”

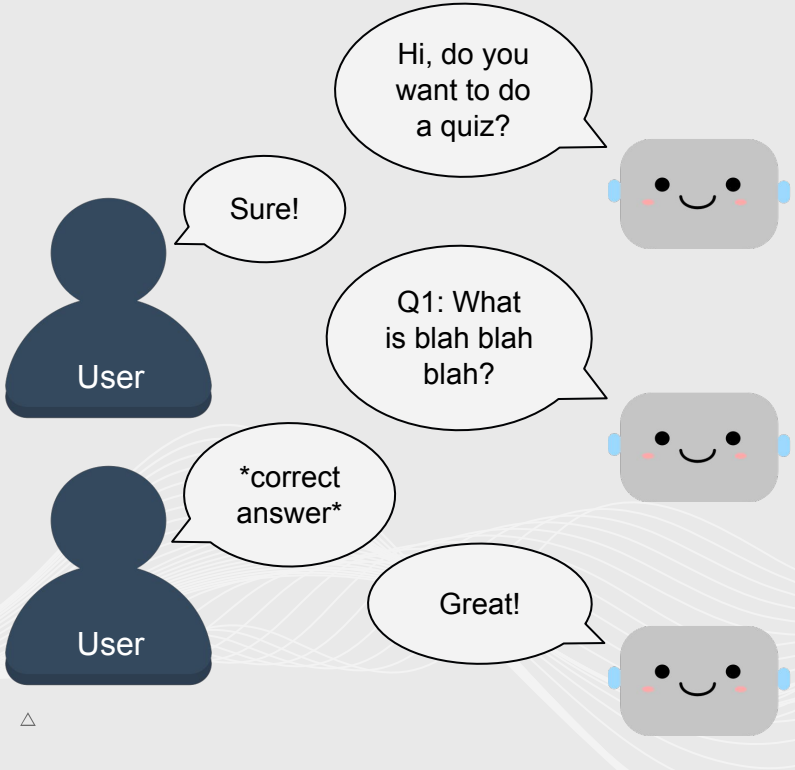
Thank you for listening!

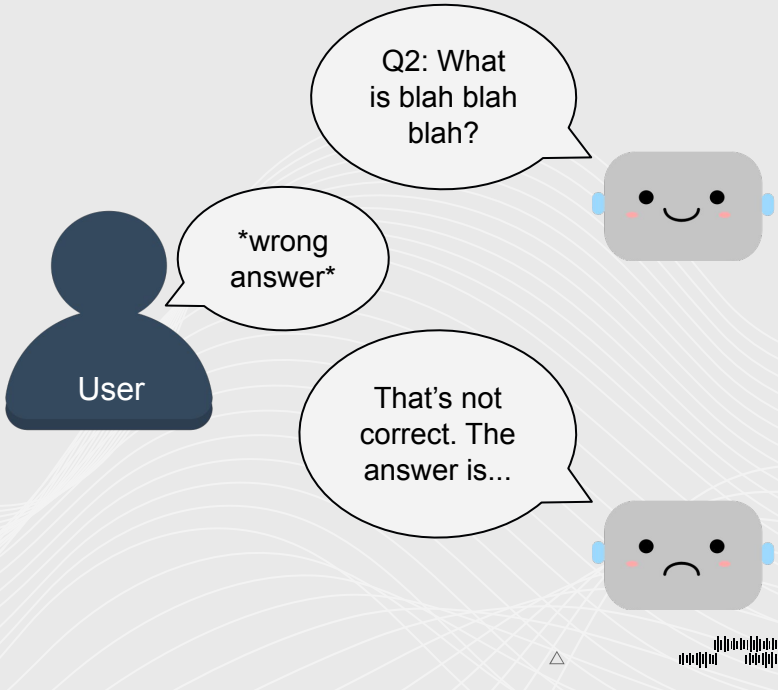
Questions?

Schedule


Task
Nov
Dec
Jan
Oct 26
Nov 2
Nov 9
Nov 16
Nov 23
Nov 30
Dec 7
Dec 14
Dec 21
Dec 28
Jan 4
Jan 11
Jan 18
CIR PROJECT 2020-21
Mid-Term Review
Code implementation
Requirements analysis
Context analysis
Target's users' profiles
Purpose & Activity
Behaviours
Cognitive skills
Bench Marking. State of art. Pros vs. cons
Description of the proposed solution
Implementation/test descriptions
justification acording theoretical framework
Final delivery documents
Report review
Slides for presentation
Project delivery
Final presentation

Interaction

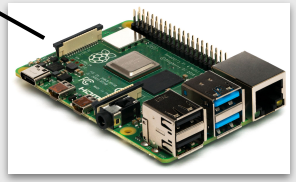




Hardware

Computation

Raspberry Pi



PC

or

Interaction

Speakers

Display

Microphone

Human Interface

- Voice 2 text - SpeechRecognition library (Python)
- Text 2 Voice
- Simple screen (text + LEDs)

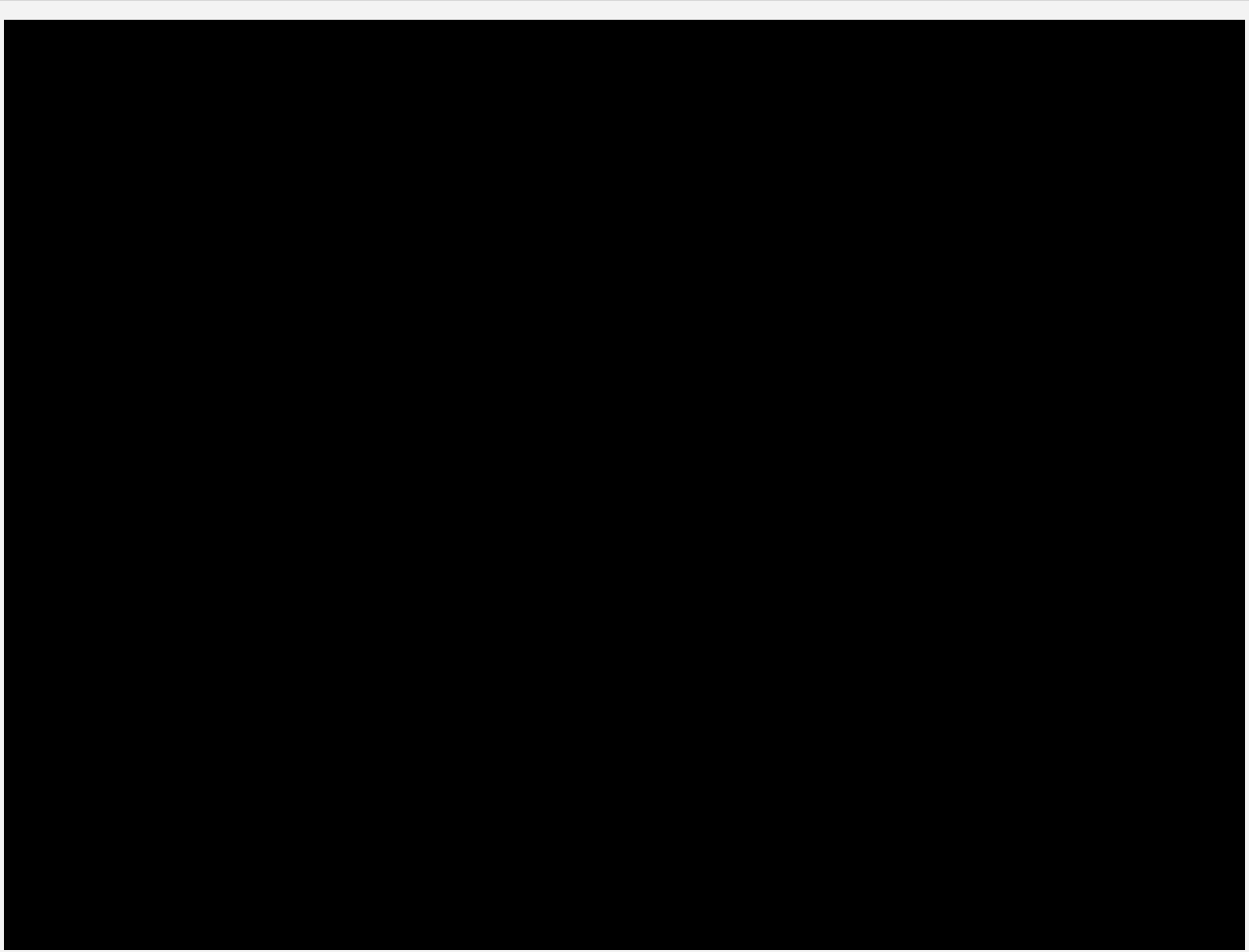
Example Question

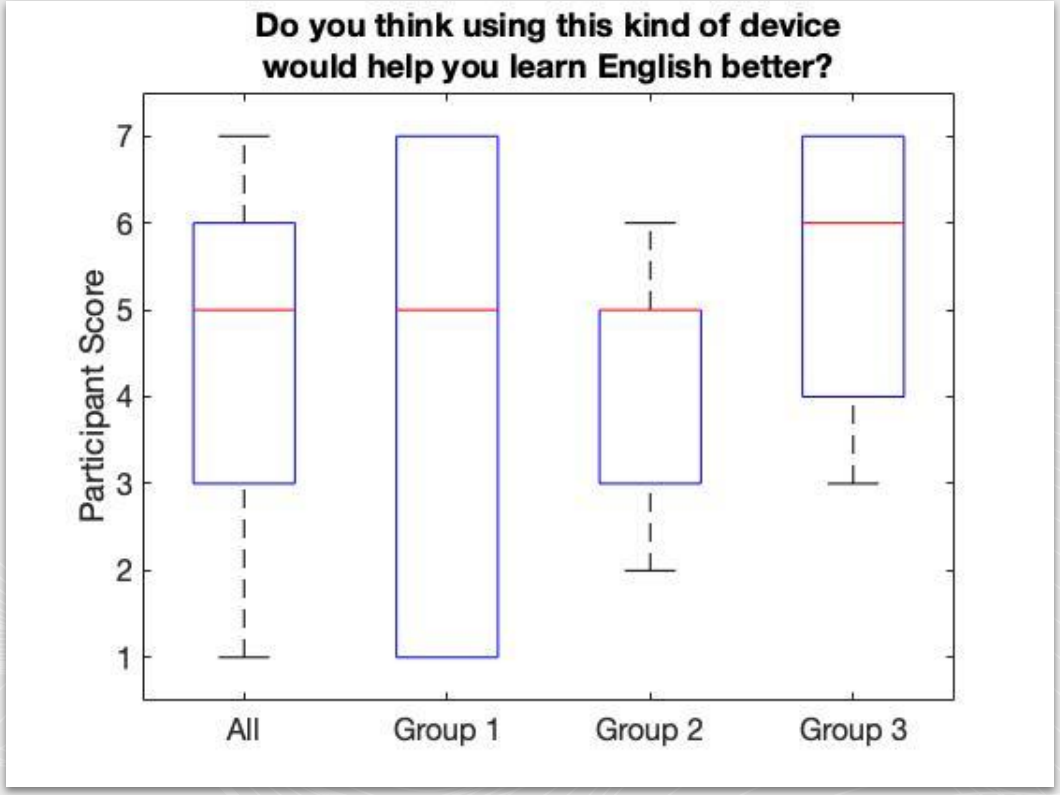
Question: "Do we know what happened to Nancy yesterday?"

Answers:

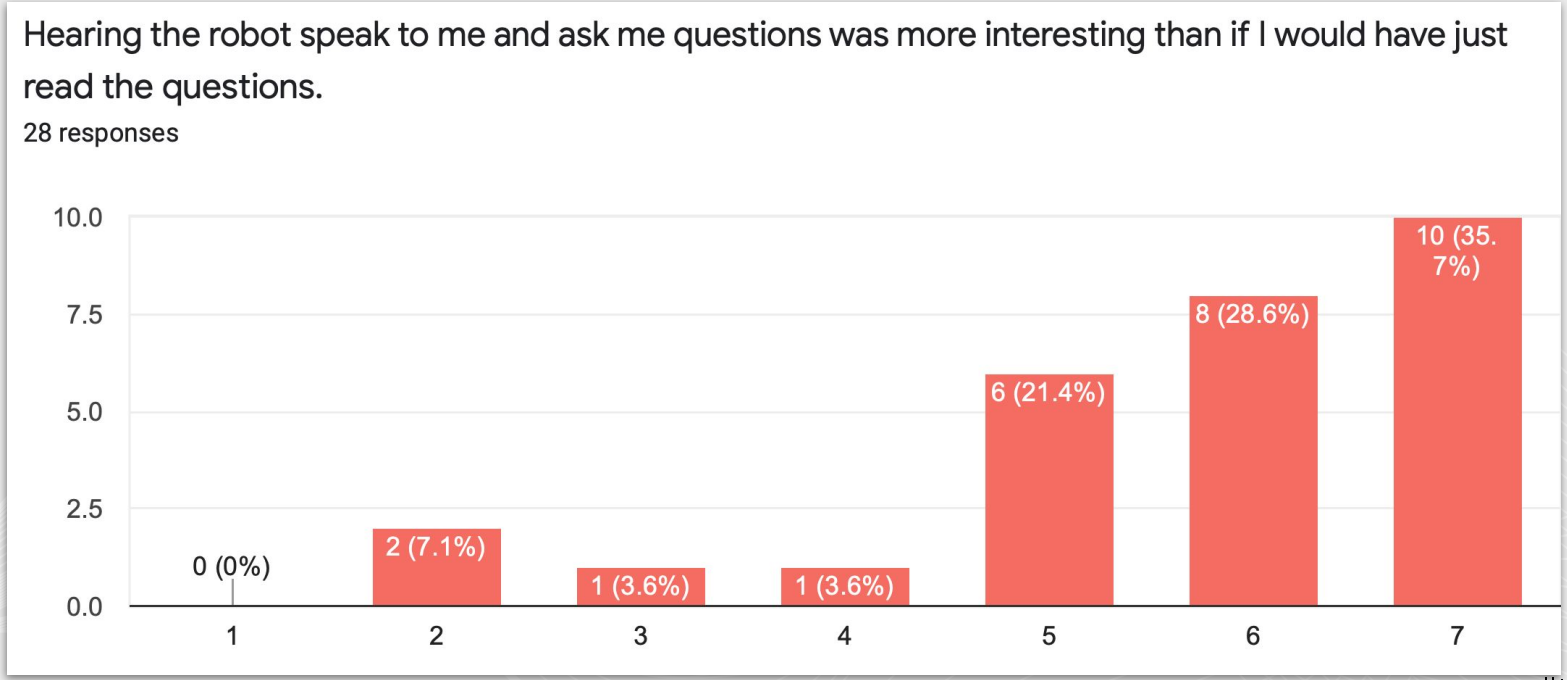
1. "She wrote down a list of instructions.",
2. "They say she retired last week.",
3. "She said she felt a pain in her chest, then passed out.",
4. "I will see her tomorrow."

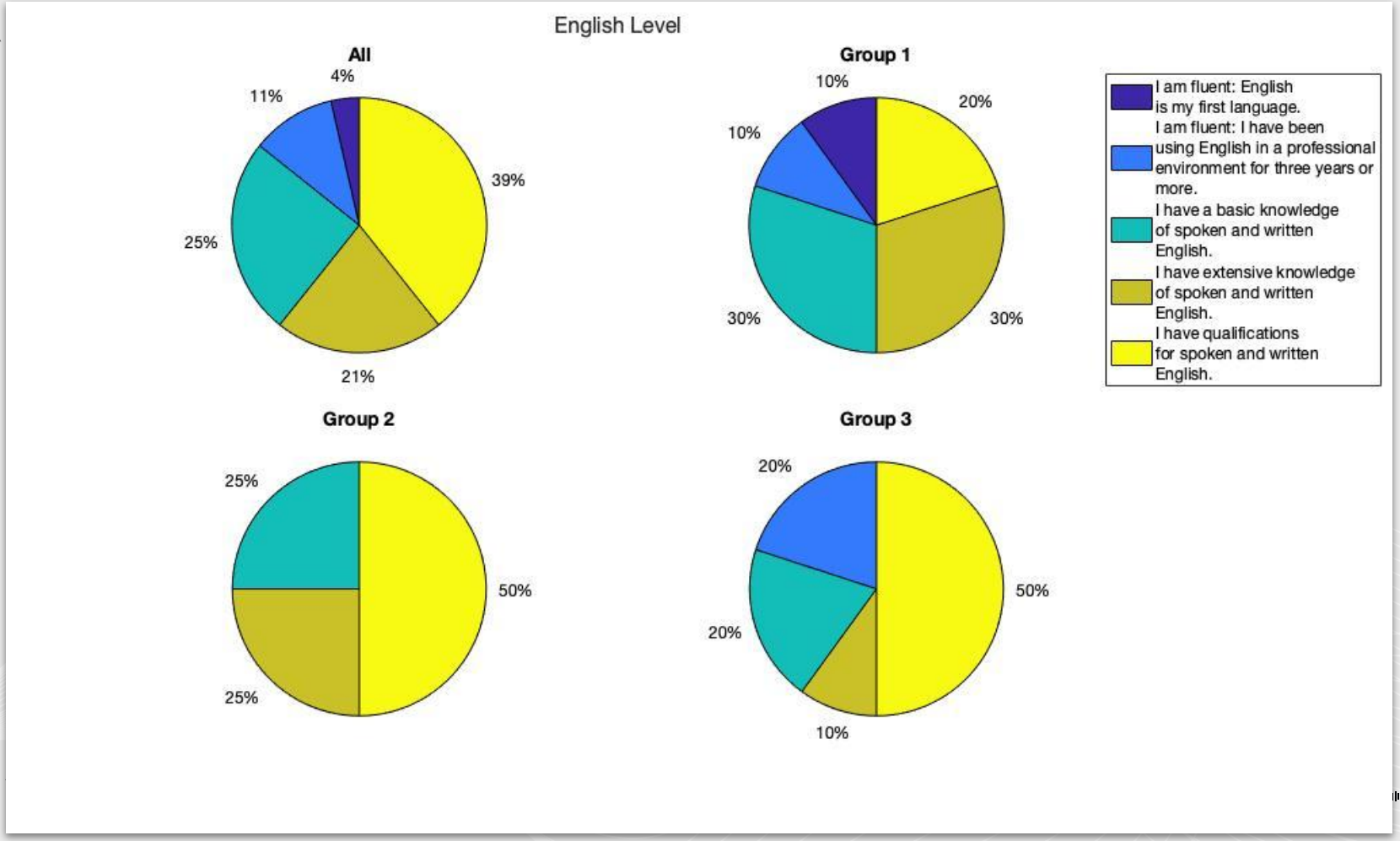
Correct answer index - 3.




Do you think using this kind of device would help you learn English better?
Participant Score
7
6
5
4
3
2
1
All
Group 1
Group 2
Group 3

Other Questions




English Level
All
4%
11%
39%
25%
21%
Group 1
10%
20%
10%
30%
30%
I am fluent: English is my first language.
I am fluent: I have been using English in a professional environment for three years or more.
I have a basic knowledge of spoken and written English.
I have extensive knowledge of spoken and written English.
I have qualifications for spoken and written English.
Group 2
25%
50%
25%
Group 3
20%
50%
20%
10%