“Oh sorry, I thought you were a chatbot 😳”

IN5480 - Group assignment - Group 5

1. Group description

Our group consists of Bendik Johann Kroken, Chris Kløv Andersen, Inger Helene Howells Engebretsen and Viljar Tornøe. We are all fourth-year students doing our masters in Informatics: Design, use and interaction. Bendik, Chris and Inger Helene did their bachelor studies at the University of Oslo, while Viljar did his bachelor's in New Media at the University of Bergen.

2. Area of interest

We would like to work with chatbots. Specifically, we want to investigate the way users interact with chatbots. We want to look at how users choose to formulate their questions when interacting with chatbots versus real people. We consider looking into whether the type of recipient influences the users' vocabulary, sentence structure and expressions. In order to do this, we want to look at how users interact with the chatbot ToastBot that we made for the student association Toastjærn earlier this semester.

It would also be interesting to look at the expressions the chatbot uses compared to what a human uses, but since ToastBot does not generate its own sentences, this will not be relevant to us in this task. All sentences that ToastBot write are written by the developers. The chatbot only recognizes certain keywords and replies with the answer that is connected to that specific buzzword.

We are interested in this topic because we all have experiences with either being mistaken for chatbots (through work) or experience using chatbots ourselves. Chatbots are increasingly becoming a larger and more important part of how users interact with companies and this, as Brandzæg and Følstad says, will pose an array of new challenges to HCI (Brandzæg & Følstad, 2017:38-40). Therefore we wish to investigate this concept, and gain insight into the experience of interacting with

chatbots, here through language. Another interesting aspect of chatbots and their interaction with users is how the users expect the chatbot to behave. Jenkins et al.(2007), argues that users expect chatbots to both behave and communicate like humans, creating new challenges (Jenkins et al. 2007:83). Drawing upon this we could investigate how this claim carries over to Toastjærns chatbot.

The users we want to include are users who are in the target group for the Toastjærn association. Since Toastjærn is an association affiliated with the Institute of Informatics, it would be interesting to focus on students at IFI. We think it would be interesting to include people who do not necessarily know too much about the student association. If they do know a lot about Toastjærn already, the conversation might not be as natural or organic as it would be if they actually had genuine questions about the association.

In order to make the conversations as organic and natural as possible, we would like to test the chatbot in a natural setting. That will most likely be during lunchtime in the cafeteria at IFI. It is also possible that the chatbot is used during classes or while walking in the hallways, but this might be harder to study. We also do not want to encourage students to use the chatbot during class, even though this might give us an even more accurate example of how users talk to chatbots, especially when in a hurry. We would like to approach students who are eating or socializing in either the hallway or the cafeteria to not disturb their studies.

3. Questions and hypothesis

We would like to investigate this question:

“Are users less formal when they know they are chatting with a robot compared to when they think they are chatting with a human?”

Our hypothesis is that they are. Through our project, we would like to either confirm or disconfirm this. Our hypothesis is therefore this:

“Users are less formal when they know they are chatting with a robot compared to when they think they are chatting with a human?”

4. Methods

In order to find out whether the formality of user language differs between interaction with chatbots and interaction with humans, we want to ask students at IFI to chat both with the chatbot ToastBot and with a person from the board of Toastjærn. We choose to use this chatbot because it allows us to access users’ interactions with the chatbot. We could have chosen to investigate a different, more advanced and established chatbot, but since the data provided by the conversations is needed for us to further investigate the differences, we choose to use our own chatbot. If we had chosen to use a different chatbot, we would have to either ask the users to send us screenshots of the conversations, or ask the owners of the chatbot to give us insight into their data. Furthermore, by using our own chatbot we gain more knowledge about what is needed to make a chatbot.

Our approach will be similar to experimental research, and we will organize it by dividing the participants into two groups, and exposing each participant to only one condition (between-group design). The participants of each group will be aware of the existence of the association, but not necessarily know too much about it. This is because we want the conversations to be organic, and the questions to be genuine. The participants will be chosen at random, but due to practicalities, the first five participants will be directly assigned to the board member chat, and the last five participants will be directly assigned to the chatbot chat. Therefore, since the assigning of participants to conditions is not truly randomized, the experiment will only be a quasi-experiment.

When gathering data, we will initially ask five students to chat with the Toastjærn association. They will be told that a member of the board is on the other side, and we want to them to interact with them through our phones so that they remain

anonymous. The students will be asked to ask the member about the association, and that our goal is to collect data on questions asked to the chatbot.

After that, we will ask five new students to chat with the chatbot ToastBot. In order to make sure that the data is comparable to the data gathered from the chat with the board member, we will ask them to do the same as the other group did (ask questions to the chat about the association).

When all ten people have chatted with either the board member or the chatbot, we will read through the chats and look for similarities within the groups and differences between the groups.

We also consider talking with an expert on the theme at a later stage. As mentioned below, we have found articles about the effect of AI on language formality and politeness, but it would be interesting to interview someone who works with this.

5. Background

We want to investigate whether and to what extent the language users use change when talking to a robot in comparison to talking to another human being. This is a question that has been addressed by multiple scholars and tech-interested journalists. However, there is not a consensus about whether we should be polite when interacting with artificial intelligence or not. While the journalists Needleman from CallerCallsBack.com and Elgan from FastCompany.com have taken clear stances on what they mean is the right way to interact with artificial intelligences, the scientific community on the other hand has not reached a clear stance on the matter(Elgan and Elgan 2018; Gupta, Walker, and Romano 2007; Needleman 2017). In our study, we aim to investigate this phenomena further, and look at how people actually interact with chatbot in their daily practice.

Both Gupta et al. and Benotti & Blackburn have investigated politeness in human-robot interaction (Benotti and Blackburn 2016; Gupta, Walker, and Romano 2007). These studies were made on the background of people viewing robots and social actors, and thus new issues arose - how polite does one need to be when interacting with robots? Gupta et al. conclude with no clear cut answer to this question, but reports from their studies that there is a cultural component to the subject at hand underlining that politeness with conversational agents varies across both language and the embodiment of the responses of the conversational agent (Gupta, Walker, and Romano 2007).

Politeness is highly contextual(Benotti and Blackburn 2016), and as Luger and Sellen argue, chatbots often lack this contextual information, making interactions with conversational agents seem “patchy” and “off” (Luger and Sellen 2016, 5288). Kocielnik et al. argue that expectations a central tenet in our interactions with conversational agents (Kocielnik, Amershi, and Bennett 2019). Benotti and Blackburn argue that a central part of politeness theory is for the actor (the one chatting) to understand the desires and intentions of the agent, thus prompting a polite response from the actor (Benotti and Blackburn 2016, 301). This is especially interesting in the context of robot-human interaction, when this is something that cannot be done, and robots do not have desires/intentions in the way humans do. Relating to our research question, we view politeness a central part of formality, thus we think it is interesting to use the theories proposed by Benotti and Blackburn.

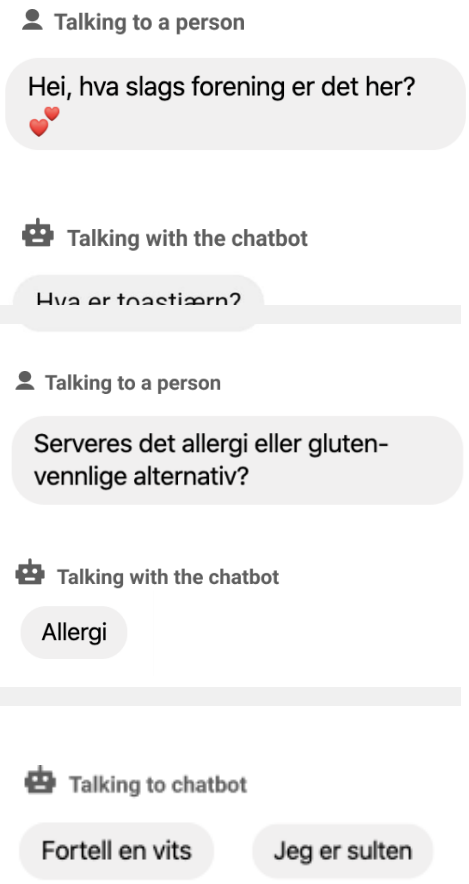
These authors create a foundation in which we aim to understand our findings. Does a lack of context and immediate responses make a reduction in politeness when interacting with chatbots, or does the opposite happen? Does expecting a robotic reply from a conversational agent triggers a more robotic response from the user?

6. Findings

Talking to a person our test participants were polite and thankful for the answers. Several of them used emojis. They would write longer sentences describing their questions and sometimes have a follow up questions after the initial answer.

When our test participants were asked to speak to a chatbot they were much more direct in their questions, often opting for one-worded indicators for their inquiries and leaving out punctuation marks.

Multiple of the users interacting with the chatbot tried “testing the limits” and trying to get the chatbot to answer funny questions or make jokes. None of the users tried doing this when they were talking to a real person,



When encountering errors with the chatbot, some participants quite quickly lost interest in conversing with it, while some tried to adapt and configure their questions to test if it would yield a new result.

Example 1:
This participant continues to feed single words into the chatbot, and when continuously receiving error messages in return, the participant quickly gave up.
Example 2:
This participant got error messages when asking questions, but was still curious to see if she could get her question answered by trying different ways of wording her questions.
Example 3:

Another participant encountered a false positive when asking about the price of a toast, getting the definition of a toast instead.

7. References

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Needleman, R. (2017). Tech Etiquette: The Real Reason You Need to be Polite to Alexa. Fetched 22.10.19. https://callercallsback.com/tech-etiquette-the-real-reason-you-need-to-be-polite-to-alexa-6a76f97d0803

8. Appendix

8.1. Chatbot design task

The first part of our meeting was deciding on which case regarding chatbots we were interested in. We decided on making a chatbot for Toastjærn, a student association here at IFI devoted to the creation and consumption of toast. A major reason for this was that Inger Helene is an active part of the association, and saw that a chatbot could make their day-to-day communication with both potential member and current members more efficient.

Due to Inger Helene already being in Toastjærn and having access to previous chats, we were able to model our chatbot on existing data making our chatbot based on real cases. Through this data we made our chatbot quite extensive so that it still could be used after the assignment was done.
We did an informal user test at a Toastjærn event, where the participants were people in line waiting for toast. We tested three people, and got interesting feedback. We got insight into how people tested the limits of the chatbot as well as the threshold of errors before they gave up and did not use it anymore. We also observed that people were more impressed than we expected of the chatbot, and thought that it was exciting and fun.

8.2. AI task

For module 2 we received a machine learning code from Dr. Morten Goodwin and dataset necessary to train a chatbot based on movie lines from the movie Gone with the wind.

8.2.1. Process:

Our process was one of trial and error. As novices to machine learning, and only having had one lecture on how to manipulate the data, we were quite confused in the beginning. We were not sure what parameters in the code to change or what to change it to. As Dr. Goodwin said during the lecture, there is no right or wrong answer. This is a try, test and evaluating process. We manipulated the number of iterations (epoch) in the code and the number of connections (dense) to some random values and reviews the results.

8.2.2. Outcome:

Test 1:

```
Train on 900 samples, validate on 100 samples
Epoch 1/2
900/900 [==============================] - 0s 115us/sample - loss: 3.2284 - acc: 0.1356 - val_loss: 3.6273 - val_acc: 0.0000e+00
Epoch 2/2
900/900 [==============================] - 0s 48us/sample - loss: 2.8095 - acc: 0.1722 - val_loss: 4.4602 - val_acc: 0.0000e+00
Finished training
ready
Chatbot:"I'm getting trashed, man." Isn't that what you're supposed to do at a party?
Human: No
Chatbot:What?
Human: Huh
Chatbot:Leave my sister alone.
Human: Leave MY sister alone
Chatbot:No -- something real.  Something no one else knows.
Human: Excuse me
Chatbot:Away.
Human: Rude
Chatbot:Something like that
Human: What do you want from me?
Chatbot:Who?
Human: ME
Chatbot:So he has this huge raging fit about Sarah Lawrence and insists that I go to his male-dominated, puking frat boy, number one golf team school. I have no sa
y at all.
Human: Honestly same
Chatbot:I hate him.
Human: Same
Chatbot:What?
Human: WHAT?!?!?!?
Chatbot:Now I do.  Back then, was a different story.
Human: Yeah, we all have lived lives before.
Chatbot:He just wants me to be someone I'm not.
Human: Oh, we are still talking about this?
Chatbot:Hey -- do you mind?
Human: Yeah, actually I do...
Chatbot:Is that right?
Human: YES
Chatbot:I guess I thought I was protecting you.
Human: From what?
Chatbot:If I was Bianca, it would be, "Any school you want, precious.  Don't forget your tiara."
Human: Now THATS a mood ;)
Chatbot:Oh, Bianca?  Can you get me my freshman yearbook?
Human: Huh?
Chatbot:I guess I thought I was protecting you.
Human:
```

Number of iterations (epoch): 2
Number of connections (dense): 512
Loss: 2.2284
Acc: 0.1356
val_loss: 4.4602
val_acc: 0
Number of interactions before crashing: Did not crash

Test 2:

```
Epoch 4/7
900/900 [==============================] - 0s 48us/sample - loss: 2.6443 - acc: 0.1722 - val_loss: 5.2759 - val_acc: 0.0000e+00
Epoch 5/7
900/900 [==============================] - 0s 47us/sample - loss: 2.6379 - acc: 0.1722 - val_loss: 5.4318 - val_acc: 0.0000e+00
Epoch 6/7
900/900 [==============================] - 0s 50us/sample - loss: 2.6337 - acc: 0.1722 - val_loss: 5.6276 - val_acc: 0.0000e+00
Epoch 7/7
900/900 [==============================] - 0s 50us/sample - loss: 2.6325 - acc: 0.1722 - val_loss: 5.7293 - val_acc: 0.0000e+00
Finished training
ready
Chatbot:Because I don't want to. It's a stupid tradition.
Human: What is?
Chatbot:Answer the question, Patrick
Human: My name is Bendik
Chatbot:Something like that
Human: Something like what?
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-3-e619be6a0d9d> in <module>
    104 s = " "
    105 while s:
--> 106     category = getCategory(s)
    107     text = getRandomTextFromIndex(category)
    108     print("Chatbot:" + text)

<ipython-input-3-e619be6a0d9d> in getCategory(inputString)
     89 def getCategory(inputString):
     90     #Get the correct classification
---> 91     token = tokenizer.sequences_to_matrix(np.array([makeTextIntoNumbers(inputString),makeTextIntoNumbers(x_train_org[0])]))
     92     aindex = np.argmax(model.predict(np.array([token[0]])))
     93     return aindex

/usr/local/lib/python3.6/dist-packages/keras_preprocessing/text.py in sequences_to_matrix(self, sequences, mode)
    410         x = np.zeros((len(sequences), num_words))
    411         for i, seq in enumerate(sequences):
--> 412             if not seq:
    413                 continue
    414             counts = defaultdict(int)

ValueError: The truth value of an array with more than one element is ambiguous. Use a.any() or a.all()
```

Number of iterations (epoch): 7

Number of connections (dense): 512
Loss: 2.6325
Acc: 0.1722
val_loss: 5.7293
val_acc: 0
Number of interactions before crashing: 3

Test 3:

```
Train on 900 samples, validate on 100 samples
Epoch 1/7
900/900 [==============================] - 0s 129us/sample - loss: 3.3569 - acc: 0.1211 - val_loss: 3.4530 - val_acc: 0.0000e+00
Epoch 2/7
900/900 [==============================] - 0s 45us/sample - loss: 3.2312 - acc: 0.1722 - val_loss: 3.5447 - val_acc: 0.0000e+00
Epoch 3/7
900/900 [==============================] - 0s 44us/sample - loss: 3.0364 - acc: 0.1722 - val_loss: 3.7387 - val_acc: 0.0000e+00
Epoch 4/7
900/900 [==============================] - 0s 45us/sample - loss: 2.8307 - acc: 0.1722 - val_loss: 4.0636 - val_acc: 0.0000e+00
Epoch 5/7
900/900 [==============================] - 0s 42us/sample - loss: 2.7075 - acc: 0.1722 - val_loss: 4.4170 - val_acc: 0.0000e+00
Epoch 6/7
900/900 [==============================] - 0s 44us/sample - loss: 2.6646 - acc: 0.1722 - val_loss: 4.6938 - val_acc: 0.0000e+00
Epoch 7/7
900/900 [==============================] - 0s 46us/sample - loss: 2.6517 - acc: 0.1722 - val_loss: 4.8563 - val_acc: 0.0000e+00
Finished training
ready
Chatbot:Tell me something true.
Human: I love you.
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-4-025a1105c1ec> in <module>
    104 s = " "
    105 while s:
--> 106     category = getCategory(s)
    107     text = getRandomTextFromIndex(category)
    108     print("Chatbot:" + text)

<ipython-input-4-025a1105c1ec> in getCategory(inputString)
     89 def getCategory(inputString):
     90     #Get the correct classification
---> 91     token = tokenizer.sequences_to_matrix(np.array([makeTextIntoNumbers(inputString),makeTextIntoNumbers(x_train_org[0])]))
     92     aindex = np.argmax(model.predict(np.array([token[0]])))
     93     return aindex

/usr/local/lib/python3.6/dist-packages/keras_preprocessing/text.py in sequences_to_matrix(self, sequences, mode)
    410         x = np.zeros((len(sequences), num_words))
    411         for i, seq in enumerate(sequences):
--> 412             if not seq:
    413                 continue
    414             counts = defaultdict(int)

ValueError: The truth value of an array with more than one element is ambiguous. Use a.any() or a.all()
```

Number of iterations (epoch): 7
Number of connections (dense): 86
Loss: 2.6517
Acc: 0.1722
val_loss: 5.7292
val_acc: 0
Number of HCI interactions before crashing: 3

Test 4:

```
900/900 [==============================] - 0s 81us/sample - loss: 2.6383 - acc: 0.1722 - val_loss: 6.1386 - val_acc: 0.0000e+00
Epoch 7/10
900/900 [==============================] - 0s 65us/sample - loss: 2.6367 - acc: 0.1611 - val_loss: 6.3117 - val_acc: 0.0000e+00
Epoch 8/10
900/900 [==============================] - 0s 65us/sample - loss: 2.6363 - acc: 0.1722 - val_loss: 6.5062 - val_acc: 0.0000e+00
Epoch 9/10
900/900 [==============================] - 0s 68us/sample - loss: 2.6393 - acc: 0.1667 - val_loss: 6.4885 - val_acc: 0.0000e+00
Epoch 10/10
900/900 [==============================] - 0s 65us/sample - loss: 2.6389 - acc: 0.1722 - val_loss: 6.4720 - val_acc: 0.0000e+00
Finished training
ready
Chatbot:I just need to lie down for awhile
Human: Me too.
Chatbot:Block E?
Human: Sure
Chatbot:Why 're you doing this?
Human: Because I am tired.
Chatbot:I guess I thought I was protecting you.
Human: Thanks, but no.
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-2-ed11121f4b09> in <module>
    104 s = " "
    105 while s:
--> 106     category = getCategory(s)
    107     text = getRandomTextFromIndex(category)
    108     print("Chatbot:" + text)

<ipython-input-2-ed11121f4b09> in getCategory(inputString)
     89 def getCategory(inputString):
     90     #Get the correct classification
---> 91     token = tokenizer.sequences_to_matrix(np.array([makeTextIntoNumbers(inputString),makeTextIntoNumbers(x_train_org[0])]))
     92     aindex = np.argmax(model.predict(np.array([token[0]])))
     93     return aindex

/usr/local/lib/python3.6/dist-packages/keras_preprocessing/text.py in sequences_to_matrix(self, sequences, mode)
    410         x = np.zeros((len(sequences), num_words))
    411         for i, seq in enumerate(sequences):
--> 412             if not seq:
    413                 continue
    414             counts = defaultdict(int)

ValueError: The truth value of an array with more than one element is ambiguous. Use a.any() or a.all()
```

Number of iterations (epoch): 2
Number of connections (dense): 86
Loss: 2.6389
Acc: 0.1722
val_loss: 6.4720
val_acc: 0
Number of interactions before crashing: 4

Test 5:

```
0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.
0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.
0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
Train on 900 samples, validate on 100 samples
Epoch 1/2
900/900 [==============================] - 0s 123us/sample - loss: 3.3891 - acc: 0.1489 - val_loss: 3.4099 - val_acc: 0.0000e+00
Epoch 2/2
900/900 [==============================] - 0s 45us/sample - loss: 3.3640 - acc: 0.1722 - val_loss: 3.4190 - val_acc: 0.0000e+00
Finished training
ready
Chatbot:Not all experiences are good, Bianca. You can't always trust the people you want to.
Human: This is true
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-4-8d4a9e2e20ac> in <module>
    104 s = " "
    105 while s:
--> 106     category = getCategory(s)
    107     text = getRandomTextFromIndex(category)
    108     print("Chatbot:" + text)

<ipython-input-4-8d4a9e2e20ac> in getCategory(inputString)
     89 def getCategory(inputString):
     90     #Get the correct classification
---> 91     token = tokenizer.sequences_to_matrix(np.array([makeTextIntoNumbers(inputString),makeTextIntoNumbers(x_train_org[0])]))
     92     aindex = np.argmax(model.predict(np.array([token[0]])))
     93     return aindex

/usr/local/lib/python3.6/dist-packages/keras_preprocessing/text.py in sequences_to_matrix(self, sequences, mode)
    410         x = np.zeros((len(sequences), num_words))
    411         for i, seq in enumerate(sequences):
--> 412             if not seq:
    413                 continue
    414             counts = defaultdict(int)

ValueError: The truth value of an array with more than one element is ambiguous. Use a.any() or a.all()
```

Number of iterations (epoch): 10
Number of connections (dense): 2111
Loss: 3.3640
Acc: 0.1722
val_loss: 3.4190
val_acc: 0
Number of HCI interactions before crashing: 1

Test 6:

```
Epoch 297/300
900/900 [==============================] - 0s 43us/sample - loss: 2.6225 - acc: 0.1722 - val_loss: 9.6531 - val_acc: 0.0000e+00
Epoch 298/300
900/900 [==============================] - 0s 43us/sample - loss: 2.6234 - acc: 0.1722 - val_loss: 9.6849 - val_acc: 0.0000e+00
Epoch 299/300
900/900 [==============================] - 0s 41us/sample - loss: 2.6228 - acc: 0.1722 - val_loss: 9.7180 - val_acc: 0.0000e+00
Epoch 300/300
900/900 [==============================] - 0s 42us/sample - loss: 2.6231 - acc: 0.1722 - val_loss: 9.7461 - val_acc: 0.0000e+00
Finished training
ready
Chatbot:In 9th.  For a month
Human: What month?
Chatbot:You ' re looking at this from the wrong perspective.  We're making a statement.
Human: That is cool.
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-8-17005f256b69> in <module>
    104 s = " "
    105 while s:
--> 106     category = getCategory(s)
    107     text = getRandomTextFromIndex(category)
    108     print("Chatbot:" + text)

<ipython-input-8-17005f256b69> in getCategory(inputString)
     89 def getCategory(inputString):
     90     #Get the correct classification
---> 91     token = tokenizer.sequences_to_matrix(np.array([makeTextIntoNumbers(inputString),makeTextIntoNumbers(x_train_org[0])]))
     92     aindex = np.argmax(model.predict(np.array([token[0]])))
     93     return aindex

/usr/local/lib/python3.6/dist-packages/keras_preprocessing/text.py in sequences_to_matrix(self, sequences, mode)
    410         x = np.zeros((len(sequences), num_words))
    411         for i, seq in enumerate(sequences):
--> 412             if not seq:
    413                 continue
    414             counts = defaultdict(int)

ValueError: The truth value of an array with more than one element is ambiguous. Use a.any() or a.all()
```

Number of iterations (epoch): 1

Number of connections (dense): 12
Loss: 2.6231
Acc: 0.1722
val_loss: 9.7461
val_acc: 0
Number of HCI interactions before crashing: 2

Test 7:

```
0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
Train on 900 samples, validate on 100 samples
Epoch 1/5
900/900 [==============================] - 0s 162us/sample - loss: 3.2198 - acc: 0.1600 - val_loss: 3.6584 - val_acc: 0.0000e+00
Epoch 2/5
900/900 [==============================] - 0s 49us/sample - loss: 2.7978 - acc: 0.1722 - val_loss: 4.5060 - val_acc: 0.0000e+00
Epoch 3/5
900/900 [==============================] - 0s 48us/sample - loss: 2.6594 - acc: 0.1722 - val_loss: 5.0755 - val_acc: 0.0000e+00
Epoch 4/5
900/900 [==============================] - 0s 49us/sample - loss: 2.6430 - acc: 0.1722 - val_loss: 5.2540 - val_acc: 0.0000e+00
Epoch 5/5
900/900 [==============================] - 0s 49us/sample - loss: 2.6372 - acc: 0.1722 - val_loss: 5.4632 - val_acc: 0.0000e+00
Finished training
ready
Chatbot:My father wouldn't approve of that that
Human: Approve of what?
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-9-c5aa4aa22c26> in <module>
    104 s = " "
    105 while s:
--> 106     category = getCategory(s)
    107     text = getRandomTextFromIndex(category)
    108     print("Chatbot:" + text)

<ipython-input-9-c5aa4aa22c26> in getCategory(inputString)
     89 def getCategory(inputString):
     90     #Get the correct classification
---> 91     token = tokenizer.sequences_to_matrix(np.array([makeTextIntoNumbers(inputString),makeTextIntoNumbers(x_train_org[0])]))
     92     aindex = np.argmax(model.predict(np.array([token[0]])))
     93     return aindex

/usr/local/lib/python3.6/dist-packages/keras_preprocessing/text.py in sequences_to_matrix(self, sequences, mode)
    410         x = np.zeros((len(sequences), num_words))
    411         for i, seq in enumerate(sequences):
--> 412             if not seq:
    413                 continue
    414             counts = defaultdict(int)

ValueError: The truth value of an array with more than one element is ambiguous. Use a.any() or a.all()
```

Number of iterations (epoch): 2
Number of connections (dense): 0
Loss: 2.6372
Acc: 0.1722
val_loss: 5.4632
val_acc: 0
Number of interactions before crashing: 1

Reflections and what we learned

Given the responses were based on movie lines, it was quite difficult to understand if the chatbot was just giving random responses or not, as it gave no indication as to why it chose the movieline it did as a response. It seemed to us that the more we wavered from Dr. Goodwins initial parameters the faster the chatbot crashed, giving us a ValueError: *"The truth of an array with more than one element is ambiguous."*

8.3. Feedback from iteration 1

The feedback we got was mostly positive, though two main points we needed to take into consideration were mentioned.
First being we might not get enough data only collecting data from the ToastJærn chatbot. Second, how we were going to get realistic data during our tests, as the behavior of the participants will most likely be influenced by the fact that they are being observed.

For the first point of concern, we agree that our small data collection is not enough to make any true assumptions about our research question, but we think it will be enough for the purpose and scope of this assignment, to see if we can find any initial patterns.

To try to get realistic data, we did not watch them as they interacted with the chatbot as the participants engaged with the chatbot, but our presence did still probably have an effect. But we did not only use data from our tests. The chatbot has been operational since the start of September and has had several user interactions since then. We were not present for any of these interactions, having no effect on the users. This data was also used in our findings.