

# ELIZA: An Analysis

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## 1 Introduction

The first chatbot, ELIZA, was published by Joseph Weizenbaum in 1966 (Weizenbaum, 1966). It mimics a session with a Rogerian therapist, a method centered around facilitating the process of patients identifying and resolving their issues themselves. A typical conversation between a Rogerian therapist and patient involves repeating the patient's words back to them in a vague manner. In this type of therapy, the patient determines the direction of the conversation and its subject matter.

## 2 Limitations

### 2.1 Limitation 1

On first glance, the program seems very similar to a human Rogerian therapist in that it is able to ask questions that include previous answers. However, after initiating two separate chats with the therapist, it was evident that ELIZA simply iterates through the allotted responses for each keyword category. This is an issue for two reasons: ELIZA may repeat within a session and across sessions.

Because ELIZA simply iterates through the allotted responses of a category (e.g. the first time "my family" is used by the user results in the first allotted response under "my family", and the second time results in the second listed response), if a user triggers a keyword more than the number of allotted responses, then ELIZA will re-iterate through the responses, making it obvious that there is a pre-defined list of responses.

If a user frequently uses ELIZA and uses the same keywords across many sessions (e.g. "my family" for the first back-and-forth and "I am" for the second), the same ELIZA responses will be used.

The robotic and obvious repetitive manner caused by both of these issues diminishes the illusion of ELIZA being human. The iterative nature of ELIZA, while not ideal, may have been included

because it ensures that each pre-defined response is equally spaced apart from the last time it was used.

### 2.1.1 Resolution

Originally, when a specific keyword or phrase was used in a statement, the pre-defined therapist responses to these statements would be iterated in order, depending on how many times the keyword was previously mentioned in the session.

To tackle this limitation, a list of indices are randomly sampled using `random.sample`. This function creates a randomized list of `decomp.reasmbbs` indices which has the size `len(decomp.reasmbbs)`. When a user triggers a particular keyword category, the first of the randomized indices list will be used, then popped off the list. Once the entire list of phrases is used by ELIZA, a new random list is generated and the process repeats. By considering all possible responses in the category when randomly sampling, as opposed to simply randomly selecting one at a time, the likelihood of a response being repeated back-to-back is lower.

Before	After
[0, 1, 2, 3]	[2, 0, 1, 3]

Table 1: ELIZA response indices order before and after incorporating random sampling.

### 2.2 Limitation 2

Without fail, ELIZA welcomes all sessions with the phrase "How do you do. Please tell me your problem.". When a session is exited, ELIZA responds with "Goodbye. Thank you for talking to me." every time. Typically, humans do not greet or leave each other the same way every time, they instead use some variation of "hello" and "goodbye". Similar to the first limitation, ELIZA violates natural dialogue in that it is obviously choosing from a set of pre-defined responses, in this case, one introduction and one conclusion. This may have been a design decision to provide consistency

across sessions, giving users the power to direct the conversation, though this can still be achieved with various introduction and concluding statements.

### 2.2.1 Resolution

To correct the limited variation in introductions and conclusions, additional initial and final keys were added to the `doctor.txt` file. The statements added have a warm and interested tone by asking an initial question to the user and either thanking the user or wishing them well during the conclusion. This adds variety to the way that sessions start and end, while also adding extra human-like characteristics such as warmth and empathy.

<b>Before</b>	How do you do. Please tell me your problem.
<b>After</b>	What would you like to talk about in this session?
<b>Before</b>	Goodbye. Thank you for talking to me.
<b>After</b>	Goodbye. Have a great rest of your day.

Table 2: ELIZA responses before and after the introduction and conclusion statements were changed to introduce more variability.

## 2.3 Limitation 3

When the user uses declarative statements such as "I am" and "I am not" without any additional detail attached ("I am" vs "I am sad" and "I am not" vs "I am not sad"), ELIZA considers the individual "I am" and the one with additional information to be the same, always using responses categorized under `* i am *`. The responses under this category all contain a place for the additional information to be added. For example, a statement such as "I am having trouble sleeping" may trigger the response "Is it because you are (2) that you came to me ?", which would then be outputted to the user as "Is it because you are having trouble sleeping that you came to me ?". If instead the user were to answer the chatbot with "I am not", then ELIZA may follow up with "Is it because you are not that you came to me ?", which is grammatically awkward. The chatbot most likely defaults to the overarching category instead of being handled because of the difficulty of representing the statements with and without additional components separately. The `* in * i am *` includes both cases, however representing them separately requires a workaround.

### 2.3.1 Resolution

A keyword category was added so that anytime the user solely responds with "I am" and "I am not", a different subset of pre-defined responses is

used. The keyword category, called `declarative`, was added to `doctor.txt` and has its own set of responses that can handle these statements from the user. How the `declarative` category is used in `eliza.py` was the most sophisticated part of resolving this limitation. The simplest method was to include it in the `respond` function where it is called before the conditions for `* i am *` are met, using an if-else statement. The logic for the `declarative` statement in the `respond` function is exact to the `xnone` case for consistency.

<code>* i am *</code>	<code>declarative</code>
Is it because you are (2) that you came to me ?	I understand .
How long have you been (2) ?	I see .
Do you believe it is normal to be (2) ?	Care to explain ?
Do you enjoy being (2) ?	Can you elaborate ?

Table 3: ELIZA responses to "i am" statements before (`* i am *` category responses) and after (`declarative` category responses).

## 2.4 Limitation 4

Anytime the user answers any question with a yes or no statement, the chatbot follows up with further questions or statements that prompt a yes or no answer (e.g. "You are sure." and "You seem to be quite positive."), creating a never-ending feedback loop. This can leave the user feeling frustrated since a typical response to statements such as "You seem to be quite positive" involves a yes or no discourse marker. The reason this limitation might not have been accounted for in the original implementation is because Rogerian therapy is aimed at having the patient direct the conversation, therefore, generic and non-directing statements are acceptable from ELIZA. However, with the chatbot only providing 4 responses that are typically answered in a yes/no style, these types of statements can feel awkward and halt the advancement of the conversation.

### 2.4.1 Resolution

To remedy this, the statements "You are sure." and "You seem to be quite positive." under the keyword `yes` in `doctor.txt` are substituted with more open-ended statements such as "Please elaborate." and "Tell me more.", respectively. An additional change made was "I see." to "Why 'yes'?" since there is already an "I understand." response that has the same effect. Similar to the `yes` category, the responses under the `no` category, such as "Are you saying no just to be negative?" and "You are being

a bit negative.", are changed to "Please elaborate."  
and "Tell me more." respectively.

Before	After
yes	yes
YOU ARE SURE.	I UNDERSTAND.
yes	yes
YOU SEEM TO BE QUITE POSITIVE.	PLEASE ELABORATE.
yes i am	<i>I am feeling very sad.</i>

Table 4: ELIZA responses before and after the yes re-  
sponses were changed.

## References

Joseph Weizenbaum. 1966. [Eliza a computer program for the study of natural language communication between man and machine](#). *Commun. ACM*, 9(1):36–45.