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| Group 12 |
| Natural Language Processing and Chatterbots |
| An Examination. |

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## Introduction

The concept of natural language processing (NLP) and Chatterbots represent the perfect combination of an idea and its execution. Without natural language processing, Chatterbots would not be able to exist, as to be functional they require a base level understanding of the inputs they are receiving. Before diving into the combination of these concepts, a Chatterbot, we must first look natural language processing.

## Natural Language processing (NLP)

“Natural Language processing is a branch of computer science and artificial intelligence which is concerned with interaction between computers and human languages. Natural language processing is the study of mathematical and computational modelling of various aspects of language and the development of a wide range of systems. These includes the spoken language systems that integrate speech and natural language.”[[1]](#footnote-1) (Reshamwala, Pawar and Mishra, 2013). Thereby, the field of natural language processing is the understanding of the interaction between a human’s language input; a computer’s understanding of that input; then subsequently the computer’s language-based outputs; based on its understanding of the original inputs.   
By definition, a natural language is a language used by a human (e.g English, Chinese, specific dialects) to communicate information, knowledge, emotions, and verbal responses to situations. These are things we as humans learn to process and understand from an early age and develop further over time. These however are extremely difficult in the abstract for a logic-based computer system or machine to interpret and understand, since a computer or machine lacks the interpretive nature (by default and by human design) to pick up the nuance, meaning and structure of a natural human language.

The field of natural language processing has come a long way in a relatively short time. A crude example of this can be seen as far back as the early 1900’s. In 1922 a company called Elmwood Button Co created a children’s toy called “Radio Rex”[[2]](#footnote-2). Rex, a small wooden dog-shaped toy, was controlled using a small electromagnet that was sensitive to certain acoustic frequencies. The sensitive frequency that Rex ‘responded’ to was designed to be attuned to the user saying “Rex”, at which point a small spring would push Rex out of home as if it was responding to the users call for it. Whilst Rex did not respond to a natural language per say, rather a frequency (that just happened to coincide with a Natural language), Elmwood Button Co created what some would deem to be the first instance of a consumer good that used natural language processing. After all, what is human speech if not groupings of repeatable frequencies? Rex did respond (in the most part) to those frequencies.

Most smartphone users today would be familiar with virtual assistants such as Bixby or Siri, both of which use natural language processing to understand and implement voice commands given by a user. The creation of these virtual assistants is indicative of the massive developments in the technology from its first iteration in Radio Rex nearly 100 years before. Both Siri and Bixby can to complex statements, not simply single words and commands from the user. The virtual assistants we use today all help to collect and collate data on natural language; every time a user interacts with one, they are giving permission to those applications (and by extension the companies that own that software) to use and collect their speech in to further develop the applications. Doing this builds a database of human speech inputs, increasing the knowledge base for the applications to learn from, furthering their understanding of the natural language inputs given to them, creating a cyclical learning environment. As proliferation of the virtual assistant increases so does its knowledge base and by extension its ability to interpret and accurately understand natural language inputs.

Humans possess the innate ability to understand the intentions and meanings behind the language we use. This is important to understand when exploring natural language processing in context of machines and computers. When communicating with them we must teach the device what our language or input means before it can action what has been requested. Therefore, natural language processing as a field can be distilled down to the concept of teaching a computer, machine or device to understand human language (whether it be text or speech) the same way we do.

## Chatterbots

Now that we understand natural language processing we can really explore Chatterbots – a natural extension and real-world application of natural language processing – to its fullest. “Chatterbot” as a term was first coined by Michael Mauldin, whom created the very first chatbot ‘Verbot’[[3]](#footnote-3), and was used to describe a “software application used to conduct an on-line chat conversation via text or text-to-speech, in lieu of providing direct contact with a live human agent.”[[4]](#footnote-4) (Chatbot - Wikipedia, 2021).

The Turing Test is a “test of a machine’s ability to exhibit intelligent behaviour equivalent to, or indistinguishable from, that of a human” (Turing test - Wikipedia, 2021)[[5]](#footnote-5). The standard Turing test involves two people and one machine. Person 1 interacts with person 2 and the machine; then using the responses from both person 2 and the machine, determines which is the machine and which is the person. If person 1 is unable to come to a reliable conclusion about which is which after the interactions, then the machine passes the test. In a more realistic context, it can be difficult for a user to tell if the chatbot they are interacting with on a website is a real person or simply a chatbot. The line is becoming increasingly more blurred as the technology behind Chatbots and the natural language processing they employ develops.

As a concept, a Chatterbot is something that most internet users would be familiar with on some level. Most people have visited a website before and seen the small window pop up on the screen “A service agent is here to help you”, sometimes they can be obnoxious and sometimes they can be helpful. If you have ever interacted with one before you will be familiar with the often strange syntax or manner of speaking that they utilise. Sometimes a Chatterbot may skip over certain things that have been said, instead latching on to key words or phrases and regurgitating information related to them. This is because a Chatterbot can operate in a few different ways.

One of the ways in which a Chatterbot will interact with a user is by listening for or registering key-word inputs. These key-word inputs will trigger the Chatterbot into responding in a pre-determined way, either by displaying a list of related information (to the language input) or by responding with a pre-programmed response. An example we have previously looked at is that of the Siri Virtual assistant. By nature, Siri is always waiting for an input, continuously listening for a key language phrase before running its full programming. When the key-word is spoken (“Hey Siri”), Siri will respond to the input and begin actively listening for further natural language input.

In another example, a Chatbot may be used by an online retailer or a company with a digital presence to increase its customer service availability. In this way, an online service provider can filter through legitimate customer queries and funnel them to live agents or filter more simple customer questions to help forums or website help sections. This also allows a business to filter out actual sales queries and drive them towards a real customer service agent, allowing a business to focus its finite staffing resources on sales and customer acquisition rather than general help questions.

There can often by confusion from a customer’s perspective about whether they are dealing with an actual person or a Chatterbot. While many companies do go to the lengths of explaining that their digital help assistants may be a Chatterbot, some do not, which is something that a consumer may find problematic if they try to use complex sentence structure, syntax or colloquial terms while interacting with the Chatterbot. This will cause the Chatterbot to misunderstand or read the wrong input, causing it to rely on incorrect information or miss the point of a statement or question entirely.

An example of this reports Authors interactions with a Chatterbot can be found at the end of this report.

## The Now

Nowadays, Chatterbots are everywhere. According to data from 99Firms(25+ Chatbot Statistics for 2021 - 99firms, 2021) [[6]](#footnote-6), the “chatbot industry is forecast to grow from $190.8 million dollars in 2016 to over $1.25 billion dollars in 2025”. With “47% of businesses having plans to add Chatbots to their platforms in 2021”, with at least a separate “40% of companies planning to introduce virtual assistants”.

The Chatbot industry is also overtaking the mobile app market, with “50% of companies planning to make more investment in integrating a Chatbot or virtual assistant in their website or programs than on developing a mobile app”. Furthermore, over “35 million people in the US alone interact with a chatbot at least once per month” (virtual assistants included).

From a business’s perspective, “data shows that chatbots receive a higher customer satisfaction rating than their human counterparts. With 87.58% of people reporting a positive satisfaction and interaction rating when using a Chatbot”. They also help a business get a lead and then close a sale, with “26% of sales reportedly starting with a Chatbot interaction”.

From a customer complaint resolution perspective, “80% of brands surveyed by Technology Review reported a reduction in call volume processing” as the Chatbot is able to filter out and funnel customer calls and enquiries to the correct customer service operators. “90% of brands reported measurable improvement in complaint resolution”. [[7]](#footnote-7)

At this point there is simply too much invested by customer facing companies for the technology to no longer be present. The pure costs saved by businesses, far outweigh the negative impressions a person may initially have about interacting with a Chatbot or virtual assistant. The fact that over 87% of people have a satisfactory interaction with a Chatbot is even more indicative of their staying power. When a product can reduce a business’ costs, keep customers happy and help generate sales, it means it will quickly become a staple of industry. At the cost of human-to-human interaction, the Chatbot is here to stay.

## The Future

As the databases for natural language processing grow and as Chatbots become ever more prevalent, intelligent and advanced we will see their potential uses explode. Think of all the interactions you may have with a person in a customer service facing role through-out your day, could their job be taken by a Chatbot or virtual assistant? Customer call centres are the first jobs at risk in this environment. A customer call centre employees’ job is to handle customer enquiries, if these customer enquiries can instead be handled by a Chatbot (that has a reportedly higher level of customer satisfaction), it would make financial sense for the business employing the call centre to transition to fully automated digital system that has no down time - a Chatbot.

However, most consumers still prefer to interact with a Human service agent when possible so whilst the initial fear of the call centre role disappearing may seem well founded, Chatbot integration into customer service may in fact allow a call centre agent to spend more time interacting and helping a customer than previously possible. This is because the Chatbot can collect information before a customer service agent becomes involved (name, age, account verification details) and even funnel the customer to the customer service agent best suited to help them. A Chatbot is also able to help a customer with entry level questions and provide answers, eliminating the need for a customer agent to become involved in the first place.

## Summary

While humans have always erred on the side of caution with Artificial Intelligence, (one need only look at science fiction to see the man’s worst fears about Artificial Intelligence come true) a chatbot is not something we need fear. A Chatbot learns by seeing, by interpreting and by understanding our languages and only responds to our inputs. Yes, if given the wrong learning material a Chatbot may give some sinister responses or have its purpose twisted (see the growth in Artificial Intelligence present in Sex Robots and how a Chatbot could be implemented), but these apply to all technologies their advancements in one way or another. A Chatbot used to help us solve our customer service issues, teach us a new language or skill or even as a point of interaction for our more isolated members of society is a good thing benefitting all of humankind.

## Example chatbot interactions

Graphical user interface, text, application, chat or text message

Description automatically generatedGraphical user interface, text, application, chat or text message

Description automatically generated[[8]](#footnote-8)

Figure 2 Choosing an option pushes the user through to more funnelling options. 8

Figure 1 Initial interaction options with the Optus Chatbot 8

Graphical user interface, text, application, chat or text message

Description automatically generatedGraphical user interface, text, application, chat or text message

Description automatically generated

Figure 3 Choosing a further option then funnels the user through to a customer service agent. 8

Figure 4 Questioning a chatterbot can lead to some strange answers. When entering a Keyword loaded response the Chatterbot has a difficult time ascertaining the correct response. 8

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