Chatbots 101

by V-Soft Consulting

Chatbots are all the rage. They exist for social media, websites, stores, and even business to business conversations. Chances are you've spoken to one, but may not have even realized it. Chatbots are taking over the Internet, saving companies hundreds of hours and manpower. In this eBook we will explore the world of chatbots, how they came to be, and what they are capable of.

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What is a Chatbot?

To put it simply, chatbots are computer applications powered by artificial intelligence to communicate with you. They are designed to mimic natural human conversation via an online chat interface, SMS, and sometimes, even voice chat. Despite being designed for human consumption, chatbots are also capable of communicating and gathering information from other chatbots.

There are many different names for chatbots: chatterbots, talkbots, bots, chatterboxes, artificial conversation entities (ACE), and virtual assistants. They are available for dozens of tasks, such as helping answer any legal questions you may have, being a personal therapist, or helping you keep your calendar organized. There are also some as useless as the one designed to represent a popular seasonal drink from your favorite coffee shop.

Most chatbots are preset to understand a specific range of keywords and respond with the correct input. It's more of a complex "If this, then that" situation – if the user mentions "e-mail setup", then send user "how to set up your e-mail guide". However, there are some that are much more complex and actually learn from conversations they have with other users.

What is Artificial Intelligence?

Much like how it sounds, artificial intelligence is when a computer simulates humanlike intelligence. For a computer to be considered intelligent, it must be capable of learning, reasoning, recognition, and correcting errors. It is not, however, the Hollywood interpretation of robots that are virtually human (Such as Marvin the Paranoid Android from *Hitchhiker's Guide to the Galaxy* or C-3PO from *Star Wars*). That is still purely science fiction and we are quite a long way off; it's very likely to not happen within our lifetime.

In order for a machine to act or behave like a human, they require a great deal of information about many different situations, items, categories, and relations for them to connect each occurrence to one another in a method that is called knowledge engineering. It includes groups of complex information compiled into a knowledge base and linked through building, maintaining, and using the information.

Types of Artificial Intelligence

There are many different categorizations of artificial intelligence, but some of the most well-known are:

- **Strong AI:** Strong AI is when the machine involved is developed to simulate human behavior and cognitive abilities, as well as the ability to reason and learn. This is what people typically think of when they think of AI: robots that can respond to questions, solve problems, or perform complex tasks. This type of AI is adaptive and has opportunities to expand.
- **Weak AI:** Weak AI is when a machine is designed to carry out a specific task – such as working an assembly line, or playing chess against a master chess player. It is incapable of self-improvement, so it will only be good at what it's programmed to do, nothing more.

Machine Learning

Machine Learning is a form of artificial intelligence that provides machines the capability to learn and understand concepts without being programmed specifically for that purpose. It utilizes things like Deep Learning – essentially, predictive analytics – and different algorithms for data to be logged and input into the device's knowledge base.

Machine learning algorithms are typically classified into three broad categories, depending on the information available to the machine in question. These are:

- Supervised Learning: Where data is essentially labeled and described to the machine in order for it to detect and sort the new information.
- Unsupervised Learning: Information is not specified or labeled in any way, but may be sorted in reference to their similarities or differences.
- Reinforcement Learning: The machine is given a specific goal to follow through with, followed by a review and providing feedback, whether positive or negative.

Natural Language Processing

Natural Language Processing is where a machine is capable of understanding the way a human speaks naturally. This is a very complex and challenging task for computers to comprehend, as they are very precise whereas human speech is not. Things like slang, metaphors, contractions, and other variables can result in the machine not correctly understanding requests.

Natural Language Processing (NLP) utilizes machine learning and other forms of artificial intelligence to "learn" the way their users speak, using assessments to correctly identify the user's request. It requires a considerable amount of programming, analytics, the understanding of semantics and syntax, segmentation, and tagging to function as expected.

Consider this: you're hungry and have a craving for duck. You message a local chatbot and ask for "good places with duck" – the bot quickly churns out several restaurants in your area that have duck on the menu. This would not be possible without Natural Language Processing (You'd likely get a confused bot that wouldn't be able to process your request).

In fact, chances are you've already used Natural Language Processing today. Things like Google's predictive searches, your phone's auto correct/auto complete, or even spam detectors utilize Natural Language Processing.

The Turing Test

The Turing Test was developed by an English computer scientist by the name of Alan Turing in 1950. It is a controversial test designed to test the ability of a machine to exhibit intelligent, humanlike behavior. To pass the test, the machine's replies would have to be indistinguishable from a human in a five-minute test.

Turing predicted that by the year 2000, machines would be able to fool 30% of human judges, but this feat took much longer than anticipated. As of 2017 no machines have truly passed the Turing Test, but there have been claims that a chatterbot by the name of Eugene Goostman passed the test in 2014 by fooling 33% of the judges involved into believing he was a human being.

The test was not intended to test a machine's intelligence, only that a machine behaves and acts like a human being would when faced with the same situations. As not all human behavior is intelligent, the Turing Test would also test for behaviors like lying, making typing mistakes, or responding to insults. Another reason that intelligence is omitted from the test is that machines are far more likely to solve complex mathematical problems that would be impossible (or nearly impossible) for a human to solve.

The History of Chatbots

The idea of creating a machine that had humanlike thought processes has been around for centuries. Scientists, philosophers, and even sculptors were fascinated by the idea of a humanistic automaton capable of thought.

Author Samuel Butler first wrote the idea of a mechanical consciousness in his 1872 science fiction novel, Erewhon. Despite the interest and fascination on the subject, it was not until 1966 when any form of artificial intelligence really took form: ELIZA.

ELIZA

Generally recognized as the first actual chatbot, ELIZA was developed by Joseph Weizenbaum. Named after Eliza Doolittle, a working-class character in the play Pygmalion, ELIZA was meant to emulate a Rogerian psychotherapist. It was capable of answering basic questions and asking for users to elaborate on their discussions. For example, if you told ELIZA that you were sad, it would respond with "Why are you sad?" inciting a further discussion and urging you to continue. Unfortunately, the program was not more involved than this, unable to understand the conversations it was having.

ELIZA was a groundbreaking invention despite its lack of "real" intelligence. Despite only being capable of using pattern matching and substitution methodology to form new sentences, ELIZA would receive an overwhelming response of positivity for its "human-like" conversations; even Weizenbaum's secretary was taken by the program. It inspired dozens of other chatbots both serious and comedic.

A.L.I.C.E.

One of the chatbots inspired by ELIZA was A.L.I.C.E (Artificial Linguistic Internet Computer Entity), also known as Alicebot. Alicebot was the brainchild of robotics professor Richard Wallace, officially going live in 1995. Alicebot uses AIML (Artificial Intelligence Markup Language), a programming language that describes a class of data objects (called AIML objects) and partially describes the behavior of computer programs that process them. Essentially, it will have a list of categories to discuss with the user – most bots have around 45,000 different topics to choose from – and choose the most "accurate" response for the discussion.

SmarterChild

Many older millennials will remember SmarterChild, a chatbot designed for use with various SMS platforms in the early 00s. SmarterChild was revolutionary in the fact that it was capable of providing the users chatting with news reports, weather updates, movie showings, and more. In the time that it was active, it had chatted with over 30 million users on AOL Instant Messenger and MSN Messenger alone.

SmarterChild was an enormous success, spawning multiple branded spinoffs and taking the internet by storm. It was so successful that the company that developed SmarterChild, ActiveBuddy, filed a patent for it in 2002. Unfortunately, ActiveBuddy (now Colloquis) only lasted a few more years after, Microsoft acquiring it in 2007 and subsequently decommissioning the business.

IBM Watson

While not necessarily a chatbot, IBM's Watson has paved the way for artificial intelligence. It is considered a "question answering machine" and was developed in IBM'S DeepQA project. Watson's sole purpose was originally to understand questions in natural language and respond to them correctly – all for the opportunity to play on a famous quiz game show.

Jeopardy!

In 2011, history was made when a machine contestant was on a game show. Squaring off against two former champions – one of which that had a 74 game winning streak – Watson was capable of understanding idioms, riddles, and nuances well enough to score over $50,000 higher than either of the contestants, resulting in the win of a $1 million prize.

Of course, Watson wasn't always correct, sometimes giving absolutely bizarre responses to questions asked. An example being, "Its largest airport is named for a World War II hero; its second largest, for a World War II battle." The response? "What is Toronto?????" - The correct answer was Chicago.

Fast-forward six years. Watson has expanded its capabilities, its processing capabilities, and decreased its size substantially (going from the size of a large bedroom to that of a mere four pizza boxes). Now considered a platform rather than a Jeopardy! contestant, Watson is paving the way for enterprises to create more believable virtual assistants, create more accurate reports, and perform intense research. Watson also has a division, Watson Health, which is specifically for the healthcare industry to help doctors identify and diagnose diseases.

Siri

Siri is an intelligent personal assistant owned by Apple Inc., originally developed by SRI International Artificial Intelligence Center. It was intended to be what they called a "do engine," which would allow people to utilize the Internet in ways they never had before. Rather than a search engine that would only gather regurgitated information and display it to the user, a do engine was akin to having a conversation.

Capable of scheduling events, booking reservations at local restaurants, utilizing speech-to-text to transcribe your text messages, and more, Siri has become a staple of iOS devices. Siri relies on natural language processing to understand your requests, listening to them and utilizing a complex algorithm to understand exactly what it is that you are looking to answer. It also notices a specific user's dialect, interests, and preferences so it can better custom-tailor the results to the user.

Alexa

Amazon's personal assistant, Alexa, is similar to Siri, but on a different platform. Alexa's popularity elevated by the use of Amazon Echo devices in many homes. A key benefit of using Alexa is the ability to control multiple smart devices by asking it to access that device's permissions, such as, "Alexa, turn on the living room fan."

Alexa has the opportunity to install different "skills" where developers can build different experiences and capabilities for an Alexa-enabled device. Recent additions are even games such as Hunt the Yeti, where your device will describe your situation and you will respond with which direction or action you choose to take – not unlike early text-based RPGs.

Recently, Amazon has opted to make its technology available to the public, allowing developers to access the same tools that powers Alexa. This new opportunity is called **Amazon Lex**, and it helps developers use voice or text-based chat interfaces for apps.

"There's massive acceleration happening here. The cool thing about having this running as a service in the cloud instead of in your own data center or on your own desktop is that we can make Lex better continuously by the millions of customers that are using it."

- Werner Vogels, CTO of Amazon, in reference to Amazon Lex

Tay

An experiment gone wrong, Tay was Microsoft's attempt at creating a chatbot for Twitter that would interact with users and learn from them. The bot did not even last a day, taken offline only sixteen hours after its first tweet. Why the short stint? **Microsoft did not give the bot an understanding of inappropriate behavior.**

Within the first few tweets, Tay was spewing racist, sexualized, and politically incorrect messages to other users. Of course, it initially happened due to a few users intentionally feeding it bile and exploiting the "repeat after me" functionality. As Tay was designed to learn from the interaction it had from other users, it began to use them to form individual responses that were just as tasteless. In those 16 hours of being online, Tay had tweeted over 96,000 times.

This was not the first instance of inappropriate behavior displayed by a bot; IBM's Watson had actually had a similar encounter after it read some of the entries from the slang definition website, Urban Dictionary. Watson used the information it had learned from the website to make its vocabulary much more – *ahem* – colorful, often swearing at its inquisitors when asked questions. The researchers deemed Urban Dictionary as off-limits at that time, removing it from Watson's library and giving it a "swear filter".

Microsoft seems to have learned from the PR disaster that was Tay, creating a completely new chatbot as its successor by the name of Zo.

How Do Chatbots Work?

There are many different ways that chatbots can enlighten and entertain users. Some of them are personal shopping assistants, others will help your new employees find answers to the questions they have, and some are far less practical: bad jokes, daily pictures of cats, and more. The spectrum of possibilities is broad. But how exactly do they **work**?

You can consider a chatbot as a type of app without the familiar user interface. There are inputs and outputs, a database, APIs, and a great deal of code involved. The biggest differentiator between an app and a chatbot, however, is the addition of a Natural Language Processing (NLP) engine. As human language is often imprecise, and, depending on the subject and language in question, one word can mean 500 different things *(the English word "run" currently holds the record at 645 different definitions)*.

That is exactly why the NLP engine is the key differentiator. Made up of thousands of different libraries of definitions, meanings, and classifications, the engine will identify relevant pieces of information provided by the user and determine the correct output in response. The engine uses tasks such as named entity recognition and tokenization to discern exactly what it is the user wants.

Named Entity Recognition

Named Entry Recognition (NER) is a type of information extraction that is designed to identify and classify named entities into pre-defined categories, including but not limited to:

- Companies and Organizations
- Locations
- Names of People or Products
- Expressions of Time

So an NER system would know that Jane is a person, 2013 is the 2013th year on the Gregorian calendar, and San Francisco is a place.

Tokenization

For a chatbot to understand a sentence, it first needs break up that sentence and convert it to a series of "tokens". These tokens can be anything from a word, to a number, or some form of punctuation. It can also be referred to as word segmentation. The chatbot will then categorize all of the tokens by context.

Normalizer

Normalizer is an open-source app that helps process inputs (in this case, tokens) and helps make it consumable for a bot. This could include things like typo corrections, identifying punctuation marks (so the bot knows if you are asking a question or making a statement, for example), and generally cleans up text so the bot actually knows what's going on. Recently, it has been recreated as an app called bot-lang.

How do Chatbots Understand?

The first step for a chatbot to understand conversations with a human is for it to convert the parts of speech into digestible input that it can recognize – tokens – analyzing those tokens and their meaning with Natural Language Processing.

The next thing for it to do is run all of the input through something called a Dialog Manager, which essentially will provide grammar rules to the bot and maintain the flow of information in a way that makes sense to the user. It will also assign tasks to certain outputs, such as detecting a question is responded to with the appropriate answer versus asking it right back to the user.

Pattern Recognition

Of course, not all chatbots are created equal. Some are extremely basic and can't truly understand what is being asked. It's more along the lines of memorization, only able to answer what it knows rather than applying learning techniques to understand *why* it is answering the way it is. Older bots – and a lot of retail bots, as well – utilize this process ,called pattern recognition, to communicate with users. Pattern recognition is similar to providing canned answers to questions (usually about 45,000 of them) that are commonly asked.

Consider it a type of frequently asked questions, but "interactive". Pattern recognition analyzes the sentence for specific key words – such as "sale" for a retail company – and has an automatically generated, pre-written response to it. "We have a sale on clothing today," it may state. But if you were to ask it a more complex question, or a series of statements, it would be baffled and either ask for you to clarify or give you a completely off-the-wall response.

Deep Learning

Similar to how a child learns how to communicate, deep learning is when a bot is given an artificial neural network with a loose set of rules for it to abide by. While not perfect, it is a way to experiment with different algorithms to create a bot that suits your needs.

Another benefit of deep learning is that once completed, there is no need to reprogram as the machine learns on its own. If it makes a mistake, you provide corrective action for it to learn. Not very many bots are currently utilizing deep learning due to the difficulty of creating an artificial neural network, but many companies that are actively researching it.

What Can Chatbots Do?

Chatbots are most well known for being customer service agents, able to handle a majority of a customer's questions without the need for human intervention. Did you know they are much more capable of just being support?

Chatbots can help with countless things in today's modern age. We have bots that can reserve hotel rooms, provide companionship, set up meetings between a group of people, send money between users, and more.

One of the most recent chatbots to take the world by storm is a free "lawyer bot". While it won't be replacing a human lawyer any time soon, it is capable of helping you create a case to appeal parking tickets, get reimbursed for travel complications, or provide answers to tricky legal questions.

Essentially, chatbots can do just about anything you want them to do. It all just depends on their programming. Some are even capable of reading emojis and pictures, responding to them as a normal human would. An example being when Microsoft's chatbot, Xiaoice, saw a picture of the person chatting to her with a sprained ankle, it replied asking how much pain the injury caused.

Personal Assistants & Helpers

Not using a chatbot for your business? Here are some of the most popular chatbots are there to make your day go by smoothly - or just to make your life easier in general.

AutoTLDR Bot

Most people know Reddit as "the front page of the Internet". It is a community to share just about everything on forums referred to as subreddits (such as "What Could Go Wrong?" or "Today I Learned ___"). One of the many offerings that Reddit has for its users is the AutoTLDR (Too Long; Didn't Read) Bot. It is for those

users who like to keep up with the news but don't have the time to read an entire article. It takes brief snippits of the article and creates a 450-700 character summary, posting it on the forums along with a link to the full-length article.

Mezi, Your Personal Travel Bot

Mezi is making it easier than ever to book flights, hotels, and even dinner reservations. Tell the bot when and where you want to go and where you're flying out of and it'll search and book a flight and hotel for you. No more scouring dozens of websites to find the best deal on your trip to Spain - Mezi's got you covered.

Dr. A.I.♥

Much like its name suggests, DR. A.I.♥ is a chatbot "doctor"*. It can provide basic diagnosis for many common ailments such as bronchitis, a sprained ankle, or fever by asking important and targeted questions. Dr. A.I.♥ is much different than simply using a search engine to look for the cause of your symptoms as it acts much like a sympathetic doctor would, asking follow up questions and providing recommendations for next steps. If you need a referral to a specialist, Dr. A.I.♥ is also capable of submitting these requests to real doctors to get approval - all without leaving your home.

Of course, Dr. A.I.♥* ***should not* *be used in medical emergencies and is not a complete replacement for a physical doctor.*

Food Delivery Bots

Too many to name individually, but food delivery bots do exactly that: they help you order a meal and have it delivered to you, all without having to call a restaurant. More and more companies are jumping on board with the idea, from pizza delivery chains to diners to brewpubs. Simply tell the bot your order, confirm your information and payment, and you will receive your food at your door at your designated time.

A Bot for Insomniacs

For those who are looking for company during the wee hours of the morning, there's Insomnobot. Created by the mattress company, Casper, Insomnobot is usually most active from the hours of 11 PM to 5 AM. Insomnobot will be there to talk to you about your favorite snacks, TV reruns, or what you want to do this weekend. A definite novelty bot, but entertaining, nonetheless.

News Aggregator Bots

Similar to an RSS or ATOM feed, a news aggregator bot can keep you up to date on all of the news you want to know about. Companies both large and small have their own types of aggregator bots ranging from world news to a very tailored list of what the user deems as necessary information.

A great example would be Amazon's Flash Briefing, where Alexa will either read out a summary of some trending news or provide brief audio clips of recordings.

How Can Chatbots Help Businesses?

Whether your business is a business-to-business (B2B) or business-to-customer (B2C), chatbots are capable of improving customer service, automating repetitive tasks, and freeing up significant amounts of time. Here are only a few of the benefits your business can see with a chatbot:

B2Bs

- **Internal Communications:** Improve communication between users, departments, and locations by an automated bot being able to announce news, changes, or updates.
- **Assistants:** Focused on the more administrative tasks, Chatbot Assistants are helping you document your timesheets, keeping you on track with all of your assigned tasks, or even reminding you of meetings or events coming up.
- **Knowledge Base:** Get fast, easy access to documents or information without having to search for it in an expansive library.
- **Providing Insight:** Things like stock prices, your website's page views, or amount of contacts created the previous day are only a few examples of an InsightBot.

Of course, not all the benefits are strictly internal. There are many reasons that a B2B should consider an externally facing chatbot alongside an internal one.

- **Answer Customer Questions:** A potential or existing customer may not be ready (or want) to speak to an actual salesperson, so a chatbot could be a high-level assistant, able to answer questions about products or offer advice.
- **Up-to-Date Tracking:** Keep a log of communications that are happening between customers and the bot. It gives you direct insight into what customers are looking for, what they're asking, and if there's anything you need to improve.

B2Cs

While still capable of receiving the same benefits of B2Bs (and vice versa), B2Cs have some especially good advantages of utilizing a chatbot for their business. Some examples are as follows:

- **Instant Availability:** The fact that chatbots are online 24/7 is a significant advantage when you have a product to sell. Not everyone is confined to wanting to research something between the hours of 9 AM and 5 PM, so the option to get assistance whenever there is a need is substantial.
- **Ecommerce:** Promote sales, make suggestions based on previous purchases, and even take payment with an ecommerce bot. Another example of an eCommerce bot would be one that is capable of assisting you with a purchase, providing order details, tracking information, and sometimes, even helping you with returns if what you've purchased isn't what you wanted.
- **Customer Service:** Chatbots have been practically designed to be customer service agents. Instead of having an entire call center swamped with calls about everything under the sun, there can be a chatbot to front the customers and answer basic questions. If the chatbot feels it is not capable of answering the question to the user's satisfaction, it can escalate it up to a live agent.
- **Transactional:** Some banks are even using chatbots to help you do your online banking without even having to access the bank's website. Instead, you just chat with a bot to get whatever information you need out of it.

There are many, many more benefits that a chatbot can bring to your business. As this list is not exhaustive, we encourage you to look deeper into how chatbots can help your business run more efficiently and affordably. If you're not sure where to start, we are always happy to help guide you in the right direction or build the perfect chatbot for your business.

About the Author

V-Soft Consulting Group is headquartered in Louisville, KY with strategic locations in North America and India. V-Soft is a trusted partner with experience across diverse technology stacks to help business get IT done.

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