

Modelling Chatbots with a Cognitive System Allows for a Differentiating User Experience

Eric Michiels (Executive Architect)

IBM Belgium, Eric_Michiels@be.ibm.com

Abstract. User Experience is a key differentiator in the era of Digital Disruption. Chatbots are increasingly considered as part of a delighting User Experience. But only a bright Conversation Modelling effort, which is part of holistic Enterprise Modelling, can make a Chatbot effective. In addition, best practices can be applied to achieve or even outperform user expectations. Thanks to Cognitive Systems and associated modelling tools, effective Chatbot dialogs can be developed in an agile manner, while respecting the enterprise strategy.

Keywords : Agile - Artificial Intelligence - Chatbot - Cognitive - Conversation - Conversational Commerce - Modelling - Dialog - Entity - Intent.

1 Introduction

This paper starts with the definition of Chatbots or Conversation Services and positions Chatbot Modelling effort within Enterprise Modelling. Next, sample use cases of Chatbots are explained. With the proliferation of Chatbot projects, it is possible to mention early best practices together with some key trends. Conversation Services that are built upon Cognitive Systems with associated services and tools allow to strike the balance between strategic goals and agility. Watson Services are used to illustrate this key conclusion.

2 Conversation Modelling within Holistic Enterprise Modelling

2.1 What are Conversation Services?

Conversation Services are a set of algorithms that can act on behalf of an individual or business and that can mimic human conversation. They are designed to interact with users primarily through voice or text. A Conversation Service Instance, is often called a “Bot” or “Chatbot”. Associated industry terms include, but are not limited to: Software Robot, Virtual Agent, Digital Personal Assistant, Conversation User Interface, Conversation User Experience, Conversations as a Platform, and more. We will essentially use two terms interchangeably: Chatbot and Conversation Service.

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There are two main types of Chatbots:

- Chatbots that are designed to serve one or more specific purposes for a business. You often find them in messaging Apps such as Facebook Messenger, WhatsApp, Slack, WeChat, and more. For example, you could order flowers from your local flower shop, through your favorite messaging App.
- Chatbot that are designed to help with a variety of information and other needs, a.k.a. as Chatbot Platforms. Examples are virtual assistants like Apple Siri, Google Assistant, Amazon Echo, Amazon Alexa, and Microsoft Cortana, and IBM Cloud.

Conversation Services and Chatbots are transforming how individuals interact and engage with brands. Conversation Services will probably replace the need for many stand-alone smartphone Apps that do not offer chat functions. There is no turning back to this trend! People expect to communicate in a more conversational way - anytime, anywhere. This will impact both the consumer and enterprise markets.

The top 4 messaging Apps (Facebook, WhatsApp, WeChat, Viber) account over 3 billion users combined! Moreover, the App boom seems to be over when considering the recent statistics about the number of downloaded Apps per month. Consumers are fatigued by having to download a different App for each organization. In short, brands that do not master Conversation Services will have a hard time competing in this era of digital disruption.

Today, ICT Architects often make a separation between "Systems of Record" ("SoR") and "Systems of Engagement" (SoE). An SoR is an ICT system that an organization relies on to run its core business. It is a rather stable environment, with highly integrated and consistent data and processes. An SoE is an ICT system which is used directly by customers, employees and other end users. It evolves rapidly and "engages" its users in the business processes. Conversation Services belong to latter.

2.2 Chatbot Responses must come in Different Forms

Modern Chatbots that provide the user with the expected experience, allow to answer in different ways depending on the question addressed. Some examples:

- The question "How do I change my password?", must guide the user through a sequence of steps, avoiding the user to study a complex document and a set of rules;
- The expression "Someone has stolen my credit card", might ultimately lead to a transfer to an agent;
- A customer asking, "Where is the nearest store", might be answered by the launch of a map with walking or driving directions;
- A client who types in "I need to pay my outstanding invoice", needs to be guided through the bill paying application;
- If a prospect says, "I want to cancel my service", the Chatbot should generate the necessary steps to present a retention offer;
- When a Platinum customer tells "I need to add my child to my data plan", the Telco Chatbot should allow for a cross-sell or up-sell offer;

- When a consultant is looking for the top 3 documents that allow to make the right investment decision, the Chatbot should offer these top 3 assets after involving a knowledge discovery service.

In short, the technology that supports the modelling, development and deployment of Chatbots, must support different integration paradigms.

2.3 Conversational Commerce

Today, we see five areas where Chatbots are becoming an essential part of the customer experience:

- Customer Service, adding a Chatbot to an e-Commerce website that automatically responds to the customers' most frequently asked questions;
- Mobile Apps, allowing customers to use natural language virtual agents;
- Messaging Channels such as Twitter, Slack, Facebook Messenger, and other messaging platform Chatbots that interact instantly with channel users;
- Internet-of-Things, allowing connected devices to understand language and respond to users' commands;
- Robots empowered with natural language understanding and conversational capabilities.

These five applications areas make up a new trend, known as “Conversational Commerce”, based itself on four pillars:

1. Anthropomorphism of IT: the attribution of human characteristics and value judgements to non-human beings (in this case computer algorithms). Bot interactions are evolving from “cold” to “warm” with a sufficient level of Emotional Intelligence! Today there are hotel chains where friendly and gentle humanoids answer questions from all types of guests.
2. The Concierge Economy: Robots are perfect slaves and will even anticipate human behavior. Will we be represented in the future by a Bot, as our Alter-Ego?
3. The Battle for Micro-moments: this are short mobile moments with quick information consumption and potential action (for example while waiting for a train or bus). Several needs appear during these micro-moments: knowing, buying, moving or doing. Chatbots will help with supporting these human desires.
4. The Conversational Office, or the application of Robots and Chatbots in the office. Flavors are the Digital Coworker and the Digital Manager. There are corporations today where a Bot is member of the Board of Directors.

Conversation Services will become the center of customer engagement, based on natural language interactions, uniform omni-channel experiences, multi-platform deployment, business process support, the detection of emotional states and advanced machine learning capabilities.

2.4 Conversation Modelling is part of Enterprise Modelling

Enterprise Modelling is generally an “umbrella term” covering different types of modelling: business modelling, process modelling, service oriented modelling, and data modelling. We suggest to also include “Conversation Modelling” to this set.

Conversation Modelling in this paper is about creating an outline of a typical conversation between a human being and a Chatbot. This outline models a dialog, which is a logical flow linking together a set of intents and entities. The intents are typical human user conversational expressions such as saying “Hello”, asking for pricing information, requesting access to an application, issuing a password reset, saying goodbye and more. The entities are pretty much equivalent to the abstract or concrete entities in a conceptual data model and are acted upon by the intents, such as a product, a service, an account, an application, and more. The dialogue models a typical conversation, but AI technology allows to reduce the number of scenarios to be modelled drastically. Effective and successful Chatbots can only be created and deployed after a well-considered Conversation Modelling effort.

3 Chatbots are a flavor of Artificial Intelligence

3.1 Artificial Intelligence and Cognitive Computing

“Artificial Intelligence” (AI) can be defined as “the science of making computers do things that require intelligence when done by humans.” AI development is primarily concerned with enabling computers to solve complex problems. You find task-orientated AI at work today in a variety of places, from recommendation engines to Natural Language Processing (NLP). Elsewhere AI provides the brainpower behind the face recognition technology in the computer vision systems in driverless cars and even the spam filters in your email.

Some of these AI systems use “Machine Learning”. This subset of AI enables researchers, data scientists, engineers and analysts to construct algorithms that can learn from, and make predictions based on data. Rather than following a specific set of rules or instructions, an algorithm is trained to spot patterns in large amounts of data. “Deep Learning” takes this idea further, processing information in layers where the result/output from one layer becomes the input for the next one.

Cognitive Computing is close to the idea of artificial intelligence. So, what’s the difference? An AI and a Cognitive Computing system approach a data intensive task quite differently. Imagine that both an AI and a Cognitive System need to analyse a huge database of research documents, patient records, medical reports, and specialized press articles to determine the treatment for a patient. An AI system will tell the doctor which actions to take based on its analysis. A Cognitive System provides information to help the doctor decide. Cognitive Systems are designed to solve problems the way humans solve problems, by understanding, learning, reasoning and interacting. Ultimately, AI and Cognitive Systems are “based on the ability of machines to sense, reason, act and adapt based on learned experience”. Rather than being explicitly programmed, they learn and reason from their

interactions with their environment and human beings. A Cognitive Computing Platform provides “Augmented Intelligence” rather than Artificial Intelligence

Cognitive Computing became famous thanks to the Jeopardy Quiz back in 2011, where IBM Watson has beaten the top human players. While this quiz demonstrated the capabilities of a Cognitive System in a spectacular manner it is not representative any more for the current Cognitive Systems. First, the current generation focuses on assisted decision making, without replacing human beings. Second, the first Cognitive System could just not be reproduced and sold to customers as an on-premise solution, in an affordable and economic justifiable way. Rather, IBM chose to commercially offer the Cognitive Computing functions under the form of Services available through the IBM Platform as a Service Cloud.

3.2 The New Partnership

We all will need to get used to a new partnership. As with all paradigms, there will be some resistance from certain categories of people. But ultimately, we will appreciate that humans will focus on common sense, morals, imagination, compassion, abstraction, dreaming and generalization. Cognitive Systems on the other hand, will provide augmenting services like locating knowledge, pattern identification, natural language recognition, machine learning and eliminating bias. Their endless capacity will be of huge value. Chatbot Modelling Tools include Cognitive capabilities, which make the modelling faster, easier, and more productive. They assist human beings with staying in control of morals, and as such help with overcoming opposition against Cognitive Systems.

4 Chatbot Trends and Best Practices

4.1 Some Sample Use Cases of Chatbots

Today Chatbots are gaining increasing adoption across several industries. An office supply retailing corporation wanted to provide anywhere, anytime service. The “Easy Button” was deployed, launching a Chatbot, allowing to order supplies from a variety of devices using voice, text or email.

A company specialized in digital communications, social media, channel marketing, integrated campaigns, content creation and delivery, is transforming client applications into Chatbots that users can engage with using natural language.

A bank in Scotland launched a pilot with a Cognitive Chatbot that allows people to interact with an AI-powered platform. It frees advisors from spending time on simple, easily-addressed queries so they can help customers with more complex issues and questions.

A Belgian bank launched a Chatbot for its teenage clients, guiding them through the banking products and services, using the jargon they are familiar with.

There are many more examples across multiple sectors: Energy and Utilities, Media and Entertainment, Telco, HR, Retail Banking, Automotive, Hospitality and Hotels, IT Helpdesks, to just name a few.

4.2 Chatbot Trends

Conversation Services and Chatbots are being heavily discussed in all media channels. Expect the hype to continue throughout 2017 and 2018 as vendors add offerings, the media publishes articles and the social media buzz. While the leading business benefits sought are “improving user experience” and “increasing productivity”, there are some more trends to notice:

- Chatbot startups are in early stages of growth, but seem to benefit from relatively great investments.
- Developers want tools that make it easier for them to model and integrate Conversation Services with other platforms, including IoT, Mobile, and Cloud.
- While the top early use cases include customer service and support, customer advice and recommendation, and Conversational Commerce, the leading verticals include computer and professional services, retail and manufacturing.
- Facebook Messenger and Slack are the most popular Bot platforms; Facebook Messenger is a leader among consumer Bots and Slack leads for business Bots.

4.3 Barriers for Adoption

We list a few barriers for adoption that were mentioned by user communities:

- Discoverability: there’s not always a simple way to find and begin using Chatbots.
- There is a skills gap: Natural Language Processing is not a core competency in IT departments. Developer tools and platforms are still nascent.
- Enterprises are very careful of Chatbots causing brand-damaging blunders. Also, robust connectivity that integrates Chatbot capability into existing infrastructure is required. Support for multiple languages is a “must” but not always available.
- Consumers are concerned about privacy breaches and security issues.
- A lot of Chatbots disappoint today as they are not necessarily intuitive enough.

4.4 Chatbot Best Practices

Although Chatbot Modelling is still in its infancy, and the first assets are just starting to appear, we are already able to describe some early best practices. Generally, there is no one-size-fits-all, so Chatbots are built based on an organization’s specific needs.

- Give the Bot personality. It is an official representative of a brand, so its dialogues now constitute part of the services and products! When talking about “personality”, it is also about making a Bot sound less like a machine.
- Choose the features carefully. The more features, the longer it will take to build a Chatbot, and the more likely it will malfunction. The Bot must be fine-tuned with

features that add value. Jokes are great, but users will appreciate a Chatbot that can also answer their concrete questions.

- Make your Chatbot proactive. Many users are not sure how to use them and sometimes decide not to interact with them at all. To counter this, build a proactive Chatbot that interacts with relevance with users as soon as they open their chat window (e.g. browsing products, making a purchase).
- Use the Bot as a customer self-service tool, as this will save time and resources. This requires that users must have the ability to change their profile information, update their billing details, view products and services, view their purchase history and order statuses, process orders, schedule appointments with human representatives.
- The most successful Bots are used as a part of a holistic online marketing strategy. They can be used for example as distribution channel for exclusive promotions and offers, and collecting user information to build buyer personas.
- Connect the Chatbot to e-commerce platforms to take orders and payments via messages, posts, and comments.
- Optimize the Bot by using in-depth metrics with the goal to track performance. Aspects of a Chatbot to be tested are its way of invocation, its tone of voice, the conversation flow, and its self-serving options.
- IT Needs to get involved with Chatbots. The reasons are security (avoid phishing via Chatbots for example), Chatbot support, budgeting and ownership (Chatbots cross often the entire customer lifecycle), and integration with enterprise systems.

5 Watson Services for Modelling Conversation Services

In this chapter we describe a Cognitive System for modelling and deploying Conversation Services or Chatbots, which is accessible as a Watson Conversation Service. This is a Chatbot Platform in the Cloud.

5.1 IBM Cloud

The IBM Cloud Platform as a Service provides a wealth of Web Services and APIs. It is an open standard based Cloud platform, that supports the development, deployment, running and maintenance of Applications and Mobile Apps. Please consult <https://www.ibm.com/cloud/why-ibm>.

5.2 Watson Services

An important set of Web Services and corresponding APIs belong to the category “Watson”. These allow to develop new or enrich existing applications with Cognitive capabilities. For Chatbot modelling and development, Watson Conversation Service is the core.

5.3 Watson Conversation Service

A Watson Conversation Service Instance which can be invoked by one or several Applications via an API. Watson Conversation Service includes also a modelling tool that allows for iterative dialog development. The Cognitive aspect is in the fact that the tool does not need to be trained with all possible options and variations.

The invoking applications can also be Messaging Platforms such a Facebook Messenger and Slack. Within a Service Instance, one or several Workspaces can be created. Such a Workspace allows to model entities, intents and dialogs. These constructs allow to quickly build dialogs for a Chatbot.

Intents are purposes or goals expressed in a customer's input, such as answering a question or processing a bill payment. By recognizing the intent expressed in a customer's input, the Conversation service can choose the correct dialog flow for responding to it. Entities represent a class of object or a data type that is relevant to a user's purpose. By recognizing the entities that are mentioned in the user's input, the Conversation service can choose the specific actions to take to fulfill an intent. The dialog uses the intents and entities that are identified in the user's input, plus context from the application, to interact with the user and ultimately provide a useful response. The Cognitive aspect is in the fact that the tool does not need to be trained with all possible options and variations.

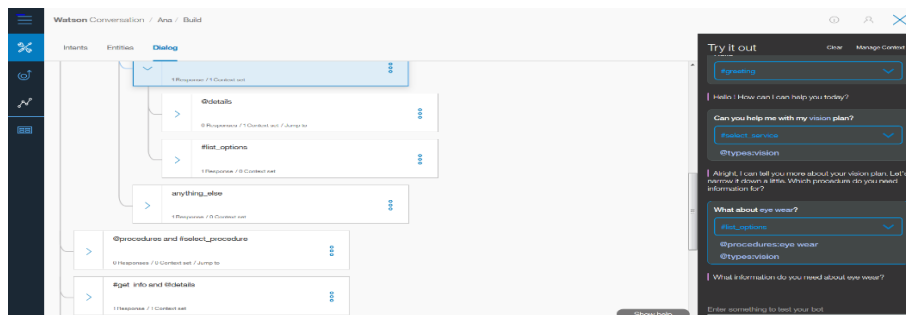


Fig. 1. Example of a modelled dialog, and the built-in agile testing tool.

Watson Conversation Service supports an increasing number of languages: English, Arabic, French, German, Italian, Spanish, Portuguese, Japanese, Korean, Chinese, Czech, and Dutch. Watson Conversation Service instances can scale easily when the number of chatting users increases. The standard pricing model is based on the number of API calls, making the tool really cost effective.

Watson Conversation Service could be trained by business experts from the business to cover approximately 80 % of the high frequency questions and associated dialogs. But for the remaining 20 % of low frequency requests, it might be very difficult and costly to model for all these possible scenarios. For these use cases, it is a wise practice to cover the frequent requests with Watson Conversation Service and cover the remaining less frequent requests with the results of knowledge discovery in documents and articles, using Watson Discovery Service. For the latter, the end user

would receive a suggested set of links to relevant information, instead of a to-the-point answer.

Organizations that deploy a Chatbot, often like to know what the overall sentiments during the dialogues have been. A tool like Watson Tone Analyzer allows for this type of analysis, providing insights about the conversation sentiments in an objective manner, allowing to fine tune the customer experience.

Watson Conversation Service based applications can also be extended with other Watson Services like Speech-To-Text, Text-to-Speech and Visual Recognition, contributing to an even more human-like experience.

6 Conclusion

As key contributors to the user experience of today's Web Applications and Mobile Apps, Chatbots are gaining continuously ground in enterprises. To ensure that Chatbots can efficiently solve problems while having a natural feel, the conversation models should be included in enterprise architecture. A Cognitive Conversational Service keeps the effort of Conversation Modelling agile, yet leads to an impacting user Experience which supports the Enterprise Strategy.

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