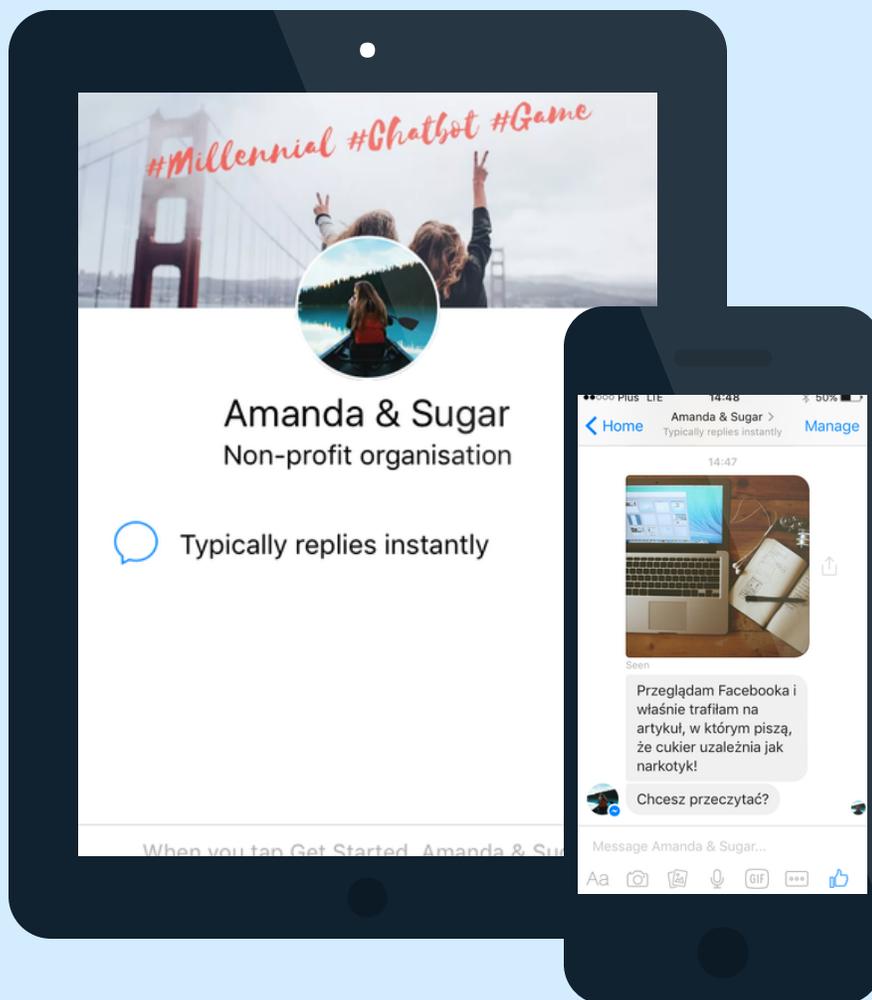


# nlu



#### HEALTH ACTION TANK

Health Action Tank is a research organization which's role is to provide actionable insights on the psycho-sociological impact of healthcare technologies before they become mainstream challenges.

Project Lead: Agata Piekut, CEO

#### IBM WATSON HEALTH

IBM Watson Health's mission is to empower leaders, advocates and influencers in health through support that helps them achieve remarkable outcomes, accelerate discovery, make essential connections and gain confidence on their path to solving the world's biggest health challenges.

Project Lead: Grzegorz Przybycien, Solution Design Lead Architect

As with any other business decision the first question we need to ask ourselves is why implement chatbots in the first place. Before anything else we need to define the expected gain, the improvement of the status quo. Only then we can try to convince our clients to use this innovation. So: where's the business gap that you can fill?

The answer is: personalisation. On time, cost effective and too expensive or complicated for you and your client to address it in a traditional manner.

A recent research shows that smartphone users spend 75 % of the time on chatting and messaging platforms. This means that software based on CUI would be their natural choice of tackling different issues. It comes with one screen convenience and as apps are getting more complicated every day, consumers get tired of going through various screens to book a table in a restaurant.

Most important: new technological solutions allow it to be cross-platform (no matter if you prefer to communicate through Messenger, WhatsApp or Telegraph) and easily integrated with outside services like social media platforms (careful about data privacy). It can even run in the text message window.

From the majority of articles on CUI you'd think that what matters most is creating an emotional, human connection. But in real life what your users want is fluent and to the point conversations that adapt to their needs.

Need some examples? Ok then. Google Search doesn't engage you emotionally but is our main source of information and an expert in personalization. Pokemon Go also didn't engage its users emotionally but was a pro in engaging people in physical activity through digital entertainment.

After the form comes the content: ease of access and use of a service or its personalization. If you wonder what your chatbot could be doing, here it goes: creating personalized experience (1) while addressing issues that previously weren't due to lack of funds (2) while solving problems that appear through end-to-end customer journey in one place (3).

Where UX work is finished, the Customer Experience just starts. Properly implemented Customer Experience optimizes end-to-end customer journey according to the clients' needs, focusing on positive, undisturbed interactions through all the channels (presented with examples):

1. Pre-sale

A. digital

own: website, social media

guest: online media, independent influencers (e.g. bloggers)

B. physical

own: fan clubs or support groups

guest: traditional media, independent clubs and groups

## 2. Point of sale

### A. digital

own: own e-shop or service platform (e.g. an app)

guest: independent online shops and service platforms

### B. physical

own: shop

guest: independent shops, distributors, chains of shops, trade shows and conferences

## 3. Post-sale

### A. digital

own: online FAQ, own clients' forum or chat

guest: independent industry forums

### B. physical

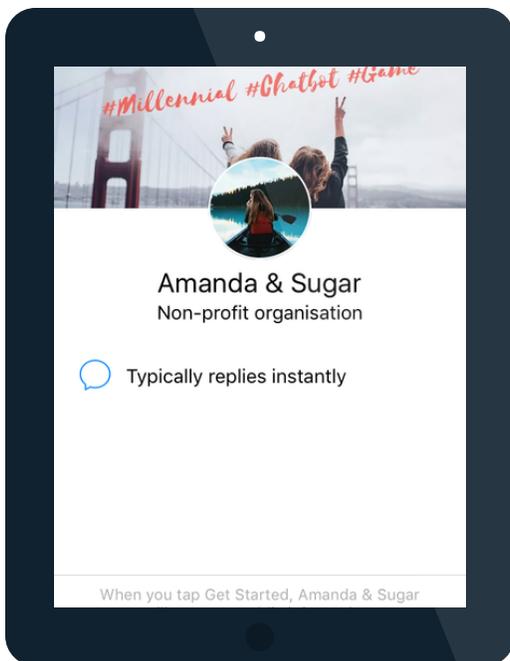
own: call center, service

guest: independent service

Apart from managing the experiences in the above channels, we can't forget the production phase and adapting solutions to the financial aspects - focusing on the products and channels that provide us with the highest profits.

This seems to be the biggest secret or the great chatbots - a profound knowledge of your clients' needs and problems at all stages of customer journey on which you can then base your automated scenarios.

Pro tip: before you start building a solution based on CUI it's good to run a Customer Experience audit.



In June 2017 we opened Amanda & Sugar – a lifestyle chatbot with tips on sugar reduction in diet for Millennials.

We wanted to check the route they'd be taking (positive/negative) and general attitude to being educated by a robot.

The main challenge we faced, was a very complicated system of communication - language in place of graphical user interfaces, or in other words, designing for natural language understanding.

In practice, today's bots still work on predesigned scenarios. However, the biggest challenge is to analyze the potential answers of users.

Based on the research, we've distinguished three aspects of NLU that have the biggest impact on H2M communication:

### 1. synonyms

In our prototype, we had 244 synonyms for 6 reaction categories, and, in case of keywords, up to 60 synonyms for one word. Majority of exchanges were based on simple yes/no template, however, we couldn't expect our users to always use just those two designated words. Making the conversation natural required finding all the possible synonyms, and then...

## 2. language errors

From typos, letters eaten to missing or excess of special characters.

We analyzed the most frequent types of typos and implemented them in the design. They consisted both of keyboard errors as well as autocorrect.

## 3. sex of the interlocutor

It's a language-specific problem that we found out designing bots for both English and Polish languages. If we can't define if the assistant is talking to a woman or man, each response of the bot needs to be prepared in a neutral tone.

There's one thing that most bot creators forget. Although language issues require the most work, we cannot omit cultural issues in the design of chatbots.

The results of the recent study are clear - over 70% of Americans are afraid of excessive interference of robots in our lives. On the other hand animism plays a very important role in Eastern culture - the belief that objects have a soul. Hence the rapid development of robotics, e.g. in Japan.

However, in our Western culture, the fear of machines is deeply rooted in us since ancient times (I will only mention the myth of Icarus). Experts are outdoing themselves in spreading fear of artificial intelligence, and the Turing test has been so strongly promoted that it has the opposite effect - there are whole online forums dedicated to finding new ways to outwit bots.

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In case of our prototype, female users' favorite method of teasing our bot was miaowing. Yes, you're not mistaken, a high number of ladies pretended to be cats.

I am pleased to inform you that we have addressed this need in the second version of our application.

The gentlemen also decided to show their creativity. Instead of answering yes/no questions they were saying "maybe". Come the second version, we also had it covered.

Chatbots can become a significant upgrade when it comes to the ease of use, not only because consumers can just talk to them in normal language but also because they're available for most messaging platforms, including text messages, and don't require users to do anything more than starting a chat on the platform of choice.

But there are some challenges, too. This is why we've partnered with IBM Watson Health to provide accurate information on practical solutions for most typical problems. Grzegorz Przybycien, Solution Design Lead Architect at IBM, answered our questions about most pressing issues regarding this technology.

**If we'd like to build a chatbot accessible only for a chosen group of users (e.g. Premium subscribers) what choice of platform would you advise us? Is it possible to restrict access to a Facebook bot?**

GP: Chatbot access restriction mechanism can be implemented on backend side and is independent from messaging platform like Facebook, Twitter, etc. For example user can be provided with access code that he or she sends to chatbot and unlocks access.

In addition chatbot backend can implement different segmentation of users i.e. based on "readiness" to change health behavior factor. Segmentation can lead to different chatbot functionality for end user.

Facebook Messenger provides good set of APIs to build user experience like user menus, integrating with web views, and linking to shopping experience.

**Apart from going through preset scenarios, some chatbots can already look for answers in databases. How hard is it to build this kind of communication structure? How do we prepare for it - do we need to structure the database in a certain way or preset all possible questions?**

GP: Chatbot can use answers designed within IBM Watson Conversation cloud service by chatbot designer. The answers are stored in Watson Conversation engine and can be modified from Web User Interface (screenshot below). This allows chatbot to determine user intent using NLP. Based on identified user intent (Trigger) it applies predefined rules to find good answer stored in Watson Conversation database. For the beginners and non-technical designers the communication structure can be modeled in simple spreadsheet two columns: user input (question), chatbot answer.

Experienced chatbot designer can use the spreadsheet data and put them into Watson Conversation cloud service. Some time it may also require to code specific UX dialog elements in third party APIs like Facebook Messenger.

**Is it possible to build a chatbot that would give personalized adjustments to the treatment according to preset recommendations from the doctor? How hard would it be to build a backend of such database?**

GP: Yes. Chatbot can use personalization and segmentation mechanism in the cloud backend system. One easy way to develop it is to put recommendations as web links in messages from chatbot. Depending on personalization user will receive a message with the different web link to his/her personalized recommendations. It depends also how often the recommendations are changing, how many different personalized recommendations are expected, who will enter recommendations - doctor vs chatbot designer.

It would not be sensible to base the future of CUI in our business solely on the third party platforms. However right now Messenger, WhatsApp and WeChat are the most popular destinations for fast client service and content marketing. This is why before implementing any strategy, it'd be good to focus for a moment on privacy and data security of such chatbots.

The not so welcome truth is that unless a platform provides end-to-end encryption of messages, they can read them and use for their own advertisement offer. Also in cases such as Facebook, the bot owner has access to the public data of active bot users that they shared on this platform. It's very good news for marketing professionals as it enables more accurate profiling. At the same time, it's a Public Relations nightmare as when the user's privacy and security literacy will grow, companies will have to address their choice of platform providers and the ease of use argument might not be enough.

Before drafting a strategy it's worth one's time to go through Electronic Frontier Foundation's Secure Messaging Scorecard(1).

What issues will you need to answer? According to Dr. Barbara Ondrisek (2) the most important are:

- the encryption of messages (see above)
- security of data transfer connection between the platform and bot provider
- sensitive data in not encrypted messages, as platforms' own machine learning tools, will have access to all of them
- security of backend of the bot and database

The chatbot developers community has many legal concerns regarding the safety of designing bots for outside platforms. From Facebook requirement to provide bot's privacy policy while no conversation is anonymous or private (3) to providing customer service on platforms that sell ads to the businesses' competitors (4).

Again, we've turned to IBM and Grzegorz Przybycien to talk over most pressing issues regarding the safety of chatbots and external platforms.

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(1)<https://www.eff.org/secure-messaging-scorecard>

(2)<https://medium.com/@electrobabe/privacy-and-data-security-of-chatbots-6ab87773aadc>

(3)<https://medium.com/@theWaylo/why-you-shouldnt-develop-facebook-chat-bots-no-it-s-not-what-you-re-thinking-b64b82dbe29c>

(4)<https://venturebeat.com/2016/09/03/2-big-reasons-facebook-messenger-is-the-wrong-platform-for-chatbots/>

**In May 2018 General Data Protection Regulation will come into force. It will bring very restrictive rules on data management. In case of using a third party messaging platform (e.g. Messenger), a third party bot builder (e.g. Watson Conversations) and own, internal bot data management, who is the data administrator, who has access to the data and who can process it?**

GP: Facebook Messenger has its own data protection and privacy protection policy. Messenger mobile app supports end-to-end encryption which means only user and chatbot owner can see the content of the conversation. IBM Watson Conversation service stores anonymized logs of users conversations that allow chatbot designer to verify if IBM Watson understood correctly user input (NLP algorithm) and provided right answer. In addition bot builder may decide to store history of user conversation in dedicated bot database on backend system. Bot builder needs design the end-to-end system to comply with GDPR policy.

**At this point, there are some serious concerns about the security of data when using third party messaging platforms. This is a big concern as bot owners are responsible for anything that happens with it. What would be your advice on best practices when a platform doesn't provide data encryption?**

GP: Some use cases that require sending sensitive healthcare data should not be considered to be built as chatbots connected to third party messaging platforms with no encryption support. In such cases dedicated mobile or web app can be developed to enable secure direct communication with chatbot. In addition user may use anonymized unique identifier so the transferred data can not be associated with him or her by unauthorized party.

