

# Chatbots and Conversational Interfaces: Three Domains of Use

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**Abstract.** The natural language, in its oral or textual form, represents the main medium for communicating between human beings. Over time, technological advances have provided new means and tools through which human beings can express themselves and communicate with each other, without altering the original mode of interaction. In recent years, the search for new forms of interaction between users and systems has led to the diffusion of a new possible communication method that exploits a conversational approach based on natural language, which is referred to by using the term chatbot. This paper aims at exploring new chatbot-based conversational interfaces that allow users to exploit the most used interaction strategies by human beings, that is the natural language. Among the many possible application domains, this paper focuses on the introduction of a chatbot for supporting users in interacting with services for public administration (PA), health and wellbeing and home automation.

**Keywords:** Chatbots, Conversational interfaces, Home Automation, Public Administration.

## 1 Introduction

During the last decades, a significant change in communication between companies and consumer has occurred. Companies and services of different fields have been moving from traditional to digital platforms to transact with consumers. This new kind of communication with consumers has been allowed by the implementation of new Artificial Intelligence (AI) techniques. One of these AI techniques is based on the usage of chatbots, software systems that allows us to simulate real conversations between devices and users. After briefly describing the concept of chatbot, focusing on its advantages and obstacles, in this paper an approach for the use of chatbots as new interfaces will be provided. In particular, we envisage three domains of use in

which chatbot interface can be effective. One of these cases has been already implemented and evaluated, and the results are presented. This paper represents a contribution to the study of chatbots, not only because it shows results already obtained through this recent technology, but also because it shows new domains in which chatbots could be useful.

## **2 Chatbots and Conversational Interfaces**

### **2.1 Definition of chatbot and its spread**

The term chatbot, spread from the Nineties, indicates a software system that aims at simulating and reproducing an intelligent conversation with a user. Chatbots are also called conversational agent, because they interact with user turn by turn using natural language. Conversation occurs through written messages or vocal commands – in the second case, the software is called voicebot. This paper will primarily focus on chatbots even if what emerges from this work could be also applied to voicebots.

Despite chatbot technology being of recent development, the idea of simulating a conversation similar to human talk, date back to the Sixties, when Joseph Weizenbaum implemented ELIZA to emulate a psychotherapist [11]. Today, many chatbots are deployed on the Internet for the purpose of seeking information, site guidance or FAQ answering in different domains such as customer service, education, website help, and entertainment. The development of this technology transformed traditional interfaces into Conversational Interfaces (CI).

Different types of chatbots can be identified, based on their learning capacity, the way in which they interact with the user, and the contest of application. The aim of this paper is to focus on the advantages and obstacles of these tools, without going into the details of the specific cases.

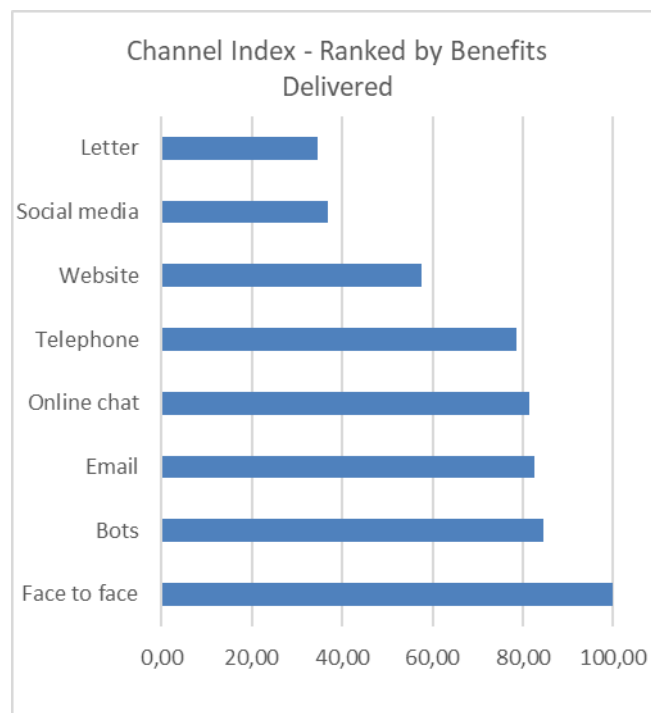
### **2.2 Advantages and strengths**

Chatbot spread is due to a bigger change in the communication between companies and users. Companies indeed are adapting their channels of communication, basically their websites, to different devices, first of all mobile devices. Given the complexity of the websites, many companies developed mobile applications in order to exploit the potentials of new tools. Today, given the saturation of the mobile application market, competition is high. Easy and intuitive interfaces are preferred, and companies are creating new channels of communication in order to involve users in building direct relationships. Relationship between companies and costumers has changed over the time, in parallel with the evolution of market. In particular, focus of marketing strategies changed. While during Seventies companies based their strategies on their product, at the beginning of the 2000s companies shifted their focus on users and costumers, creating new needs. Today companies' strategy is based on their relationship with consumers, through which companies create loyalty.

Within this paradigm, chatbots allow companies to scale mobile messaging with users, facilitating the conversation with them. For this reason, the use of chatbot is growing and it is foreseen that between 2017 and 2023 spread of chatbot will increase up to 37% [4].

One of the main advantages for the users is given by the ease of use of chatbots because they work as an instant messaging application. Furthermore, chatbots provide easy and pleasant conversations, leading to a more positive and involving user experience [1].

Compared to traditional channels of communication, such as telephone and emails, chatbots are faster and always available, ensuring quick and easy answers related to different problems. Given the possibility to manage unlimited data and users, chatbots can also replace assistance service operators, who are not always available. As a recent report by My Clever Agency demonstrates [6], chatbot is the 84.6% preferred consumer channel to get answers to simple questions, second only to face-to-face interactions, but still preferred to email or online form, chat with operators, phone, and social media.



**Fig. 1.** Users' preferred channel (My Clever Agency, 2016)

Another aspect to notice is related to the fact that today people have access to big amount of information, due to the increase of devices and channels of communication diffusion. Many studies demonstrate that the abundance of information generates a general increase of distraction: too many sources of information led people to share

their attention to different services, reducing the average time dedicated to every single source [10]. One of the main goals for companies is to catch the attention of consumers and users, optimizing the short time available. Chatbots are valid tools to solve this problem because they allow companies to create interfaces where further information that could represent a source of distraction are avoided. Consumers/users focus on the conversation, paying attention to each single information provided.

Through chatbots companies can personalize and support the relationship building with consumers/users, exploiting personal information obtained by previous interactions [2].

Finally, implementation of basic chatbots is not expensive and time-consuming. There are many open source platforms that give companies the possibility to realize a chatbot in a few months.

### **2.3 Obstacles and barriers**

Beside the above described advantages, it is necessary to mention the main obstacles to the diffusion of chatbots. The main barrier is related to the nature of the conversational agent intelligence [8]. During a complex conversation with the user it is possible that the chatbot is not able to recognize and understand users' requests and consequently it does not provide right answers. Bots are designed to follow a specific path and they rarely accommodate deviations away from a programmed script. In order to avoid this problem, it is necessary to improve the ability of artificial intelligence software, through Natural Language Understanding and Machine Learning algorithms.

Furthermore, it is foreseeable that in some cases users are reluctant to the use of chatbot. First of all, the introduction of a new technology can cause a general opposition due to the resistance of change. In some specific cases, users could be reluctant to use chatbot if they are asked to provide information that are particularly sensitive, for example personal information or bank account details.

Another obstacle is related to the difficulty to make the chatbot able to change its tone of voice with the user according to user's mood. The possibility to adapt tone of voice and tone of conversation to a specific domain and user's need is fundamental for a positive and rich user experience, and consequently for users' engagement.

As in other kind of communication channels, also within chatbot it is possible to occur the risk to use bots as just another channel to send push notifications, repurposed content, and SPAM. It is necessary for companies to consider chatbots as conversational platforms: as in a real conversation, it is fundamental not to interrupt the talk and avoid distractions that can also be annoying for the users.

## **3 Chatbots in Three Domains Of Use**

As illustrated above, chatbots are commonly used for customer services, due to the help that they can provide in managing large amounts of data. In this paper we show

three cases of mobile applications in which chatbot can be effective, for different reasons. In particular, we will show two apps that, even not already implemented, could exploit chatbot technology to be more efficient. Then, we will present the results of an analysis related to the use of a chatbot implemented by the public administration of the City of Milan.

### **3.1 I-Vitae: chatbot for sensitive data**

The Italian company I-Vitae provides a new approach to women fertility problems. The method is based on biomarkers' analysis and a panel of tests to find scientifically demonstrable correlations between imbalances in some components of the immune system and the state of subfertility or unexplained infertility. I-Vitae foresees a path that starts with a blood sample for the diagnostic test. If the results are positive for at least one of the biomarkers, the second step consists in a 6-month programme based on the consumption of a botanic natural supplement developed to regularise the menstrual cycle and to return biomarker values to physiological values. A gynaecologist supports the patient during the all programme and the end at of the 6 months another blood sample is analysed to verify the biomarkers level.

Without going into the details of the scientific research, the aim of I-Vitae is to design a mobile application that helps users in monitoring their symptoms and provides suggestions and advices, creating an ongoing interaction with the users. Users can consult the application for any question related to their path and they are asked to provide personal data related to their menstrual cycle and symptoms.

The main aspect to take into consideration is the sensitivity of the problem faced and the necessity to engage users in monitoring their menstrual cycle. In this case, we propose chatbot as a useful interface solution. Indeed, through chatbot it is possible to create a friendly conversation with the users that is necessary to face sensitive issues. I-Vitae approach is based on a continuous relationship between woman and doctor and to facilitate this interaction is one of the goal of the mobile application. Users are women facing a situation of difficulty, sometimes talking about their problem could be frustrating or painful. Personalizing the chatbot tone of voice could help in making users feel comfortable.

### **3.2 Easy 4.0: chatbot and home automation**

The second application that could be designed as a conversational interface is related to the project Easy 4.0, developed within the paradigm of Ambient Assisted Living and Home Automation. In recent years, home automation market is growing thanks to the introduction of network-enabled digital technology and the opportunities to increase the connectivity of devices within the home [5]. Easy 4.0 is an Italian research project aimed at helping users in exploiting their household appliances in the most efficient way, providing them with special "recipes" about how to set them. The goal is to create a social network where to collect suggestions and feedback directly from the users. In short, users are asked to provide their advice and opinion about the settings of a household appliance (e.g., washing machine, oven, dishwasher) so that they

can share their experiences and find the programme most suitable to their necessity: energy efficiency, environmental saving, and time saving. To develop this app, the main issue to take into consideration is related to the necessity of engaging users, encouraging them to provide their feedback. It is possible to foresee that in a platform like Easy 4.0 users are more likely to obtain the information they need than to nurture the platform giving their opinions. The problem is not related to the sensitivity of the issue faced but it is linked to a sort of expected laziness in providing feedback. Through a system of personalized push notifications and reminders it could be possible to engage users and to create a friendly relationship with them. Indeed, chatbots can reduce the effort of the users, minimizing the interaction and making the user experience easier.

### 3.3 Chatbots for public administration

Another domain of use of a chatbot interface is related to public administration sector. Requests of services from citizens are progressively growing and public administration sector have been digitalized in order to be more efficient in providing information and assistance. In this section we present a chatbot interface application developed within the Municipality of Milan (Italy). The aim of the chatbot developed is to help users in solving their issues consulting all that information that are usually provided on municipality websites. In order to design the chatbot, the main topics usually consulted by citizens have been identified. Among the most recurrent topics, three areas of information have been selected:

- Information related to traffic, circulation, restricted areas, costs and hours;
- information related to taxes for private citizens;
- general information about services, addresses and hours of administrative offices.

In a second phase of the design process, conversation flows were built in order to support users' requests and provide the right answers. Furthermore, the personality of the conversational agent was defined in order to provide answers with a homogeneous linguistic register.

For the implementation of the chatbot, developers used different tools and technologies, starting from Dialogflow, a Google Platform of human-computer interaction technologies based on natural language conversations. In order to integrate the chatbot within different websites, a landing page has been developed with HTML, CSS and JavaScript. Finally, a cloud application in Python has been developed to allow chatbot to retrieve further information from an external web service.

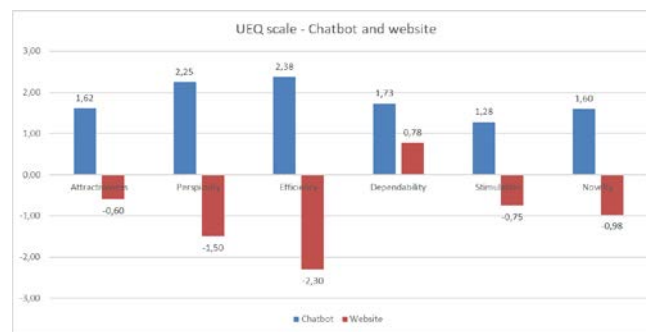
The implemented chatbot was evaluated through the User Experience Questionnaire (UEQ) test in order to measure its user experience. While SUS (System Usability Scale) focuses mainly on usability of tested device, UEQ gives information about a wider set of parameters. UEQ allows users to express feelings and impressions arise when they use the tested product and it measures both classical usability aspects, such as efficiency, perspicuity, dependability, and user experience aspects, such as originality and stimulation [7].

The experiment involved 26 users and each participant was asked to accomplish 10 task both with the chatbot and with a website that provides the same information (in particular, the website of the Municipality of Milan).

All the users were able to finish their tasks through the chatbot, even if in 12 cases questions were repeated because the chatbot did not correctly interpret them. This obstacle was due to difficult terms used by the users or complex sentence structures. After rephrasing the requests with easier terms, the test was successfully completed.

It is interesting to underline that 15 testers were not able to complete their task through the website. The main reason of their failure is that information were not coherently positioned within the webpage. Furthermore, different graphic elements represented a source of distraction: through chatbots those elements of distraction are deleted.

In general, from the analysis it emerges that users prefer chatbot interface than traditional website interaction. Figure 2 compares results related to UEQ of chatbot and website and points out a general preference towards chatbot.



**Fig. 2.** UEQ results: chatbot and website compared

As shown in detail in figure 3, the best results of the use of chatbot are related to perspicuity and efficiency. Asking chatbot the right questions, it provides an exhaustive answer in a short time, while it is necessary to be more active and to put more effort in navigating the traditional website. Learning time is another aspect that makes interaction with chatbot faster than website: while websites are always different and users need time to orient, chatbot interface is similar to an instant messaging interface, familiar to most of the people. For this reason, interaction with chatbot was up to 3 minutes faster than interaction with websites.

As shown in figure 4, better results in using website are related to dependability: users are more comfortable in navigating websites because they are more familiar with it and they consider information provided by website more reliable. Interaction with a new tool such as chatbot causes uncertainty and users consider unpredictable the information provided. This aspect is confirmed by the high level of novelty associated to chatbot.

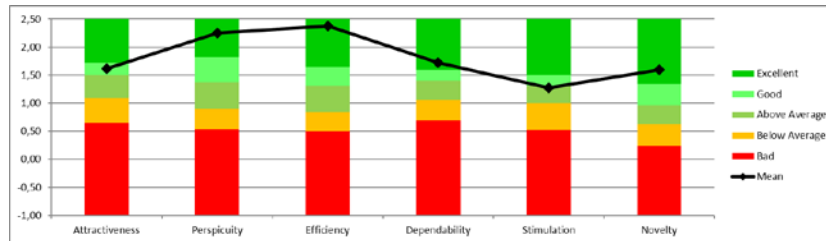


Fig. 3. Results UEQ – Chatbot

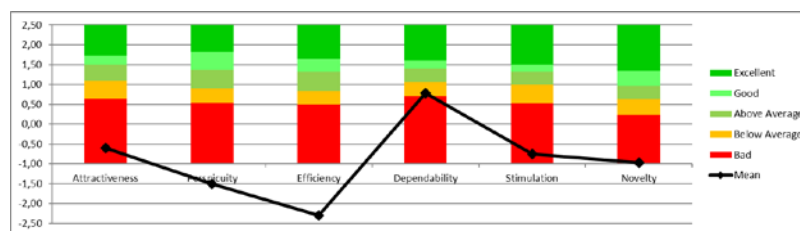


Fig. 4. Results UEQ - Website

## 4 CONCLUSIONS

In summary, we conducted an analysis of chatbot as a possible new interface to exploit within different domains of application. We analysed three different areas of use: health and wellbeing, home automation and public administration. As far as medical field mobile application, chatbots allow us to face sensitive topics without impairing users' sensitivity. To set a correct tone of voice and to personalize the agent are crucial preconditions for the success of the app. Regarding home automation, chatbots are useful to further reduce users' effort and to increase their engagement in using assistive living tools. Finally, the possibility to use chatbot within public administration field was broadly deepened through the implementation of a chatbot and its user experience evaluation. As shown by the results, chatbot could represent a solution to the need to digitalize and simplify public administration procedures. In a domain in which services provided by administration are growing, information requested by citizens are increasing. This process leads to a trade-off: on the one hand administrations need to speed up the process through which they provide information, on the other hand, citizens need to be provided with easy procedures through which they retrieve information. Thanks to chatbot technology, it is possible to guarantee information provisions on a large scale, reducing users' time and effort and increasing efficiency and efficacy of the process.

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For citations of references, we prefer the use of square brackets and consecutive numbers. Citations using labels or the author/year convention are also acceptable. The following bibliography provides a sample reference list with entries for journal articles [1], an LNCS chapter [2], a book [3], proceedings without editors [4], as well as a URL [5].

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