Development of a Chatbot to create Chatbots

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Submitted by: Sophie Smith

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Declaration

This dissertation is submitted to the University of Bath in accordance with the requirements of the degree of Bachelor of Science in the Department of Computer Science. No portion of the work in this dissertation has been submitted in support of an application for any other degree or qualification of this or any other university or institution of learning. Except where specifically acknowledged, it is the work of the author.

Signed:

Abstract

The introduction of The Internet has revolutionized the way in which we communicate in the modern day. Talking to people has never been easier leading to the potential of people being inundated with messages. To aid in automating responses to these message a chatbot can be used.

This dissertation discuss the difficulty of chatbot building for non technical people and propose the solution of a Chatbot which can be used to further create new chatbots. The results from the user study will show if the solution created as part of this dissertation is easier to use and preferred over chatbot making tool which already exist.

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Contents

1 Introduction **1**
- 1.1 Problem Description . . . 1
- 1.2 Aims . . . 2
- 1.3 Objectives . . . 2
- 1.4 Initial Requirements . . . 2
- 1.5 Summary . . . 3

2 Literature Review **5**
- 2.1 What are Chatbots? . . . 6
- 2.2 History of Chatbots . . . 6
- 2.3 Human Interaction with Chatbots . . . 7
- 2.4 Existing Chatbots . . . 9
- 2.5 How To Implement Chatbots . . . 12
- 2.6 Malicious Chatbots . . . 13
- 2.7 Summary . . . 14

3 Requirements Gathering **16**
- 3.1 Evolution of Requirements . . . 16
- 3.2 Criteria to be addressed . . . 18
  - 3.2.1 Producing Chatbot code . . . 20
- 3.3 Requirements . . . 22
  - 3.3.1 Functional Requirements . . . 22
  - 3.3.2 User Requirements . . . 26
  - 3.3.3 Usability Requirements . . . 27

4 Design **28**
- 4.1 Introduction . . . 28
- 4.2 Iterations . . . 28
- 4.3 System Architecture . . . 31

5 Testing **34**
- 5.1 Introduction . . . 34
- 5.2 Hypothese . . . 34
  - 5.2.1 Task Success Rate . . . 34

5.2.2 User Experience 35
5.3 User Test 36
5.3.1 Demographics 36
5.3.2 Materials 36
5.3.3 Design 37
5.3.4 Procedure 37
5.4 Results 38
5.4.1 Completion rates 38
5.4.2 Usability 40
5.5 Key Findings Related to System Design 41
5.5.1 Summary 43

6 Discussion and Conclusion 45
6.1 Objectives and hypotheses 45
6.2 Limitations of the Study 47
6.2.1 Time 47
6.2.2 Participants 47
6.3 Contributions 48
6.3.1 Product contribution 48
6.3.2 Research contributions 48
6.4 Future Work 49
6.4.1 Deployment Tool 49
6.4.2 Offering different platform options 50
6.4.3 User enhancements 50
6.5 Conclusion 51

Appendix A Requirement Research 55
A.1 Preliminary User Study: Questionnaire 55
A.2 Preliminary User Study:Responses 56

Appendix B User Study 59
B.1 Consent Form 59
B.2 Study Guide 61
B.3 User Test 1 and Test 2 Questionnaires 63
B.4 User Test 1: Results 66
B.5 User Test 2: Results 72
B.6 Comparison Questionnaire 79
B.7 Comparison Questionnaire: Results 81
B.8 User Test 3: Questionnaire 85
B.9 User Test 3: Results 87
B.10 User Test Timings 93

Appendix C Requirement Evaluation 94

List of Figures

4.1 Figure 1 JSON request from Facebook which requires processing to retrieve the message 32
4.2 Figure 2 Diagram to show flow of control within the system. . 33

5.1 Figure 3: The time take to complete Task 1 and Task 2 in minutes. 15 minutes marks that the user did not finish. . . . 39
5.2 Figure 4: The time take to complete Task 1 and Task 2 in minutes. 15 minutes marks that the user did not finish. . . . 40

List of Tables

A.1 Preliminary Questionnaire: Which Chatbot did you prefer interacting with?. 56
A.2 Preliminary Questionnaire: Why did you prefer interacting with the chatbot you chose in question 1? 57
A.3 Preliminary Questionnaire: Suggest any improvements to your preferred bot 58

B.1 User Test 1: Please select the task you have completed. . . . 66
B.2 User Test 1: Did you manage to complete the task on time? . 66
B.3 User Test 1: I found this tool simple to use and follow? And explanation of answer 67
B.4 User Test 1: I think I would need further instructions/support to create a Facebook chat bot using this tool and explanation of answer 68
B.5 User Test 1: I believe this tool could be used by people with a little to no technical background and explanation of answer 69
B.6 User Test 1: Does the Facebook chatbot you created do what you expected it to do? 70
B.7 User Test 1: I understood the process of making a chatbot and explanation of answer 71
B.8 User Test 2: Please select the task you have completed. . . . 72
B.9 User Test 2: Did you manage to complete the task on time? . 73
B.10 User Test 2: I found this tool simple to use and follow? And explanation of answer 74
B.11 User Test 2: I think I would need further instructions/support to create a Facebook chat bot using this tool and explanation of answer 75
B.12 User Test 2: I believe this tool could be used by people with a little to no technical background and explanation of answer 76
B.13 User Test 2: Does the Facebook chatbot you created do what you expected it to do? And Explanation 77
B.14 User Test 2: I understood the process of making a chatbot and explanation of answer 78

B.15 Comparison Questionnaire: Out of the 2 tools you used which tool did you prefer? And Explanation 81
B.16 Comparison Questionnaire: Which of the 2 tools would you use if you were going to create a Facebook chatbot in the future? And Explanation 82
B.17 Comparison Questionnaire: Which of the 2 tools produced a chatbot closest to your expectation? And Explanation 83
B.18 Comparison Questionnaire: Which of the 2 tools gave the most user friendly experience? And Explanation 84
B.19 User Test 3: What tool did you use? 87
B.20 User Test 3: Does the Facebook chatbot you created do what you expected it to do? And Explanation 88
B.21 User Test 3: How did using this tool make you feel and please explain your answer (e.g. happy, sad, confused) 89
B.22 User Test 3: Would you use this tool again to create a chatbot? And Explanation 90
B.23 User Test 3: Please identify some of the key features that you liked about this tool 91
B.24 User Test 3: Please identify some of the key features that you disliked about the this tool 92
B.25 User Test 3: Can you suggest any improvements to this tool? 92
B.26 User Test Timings (minutes) 93

C.1 Requirement Evaluation 94
C.2 Requirement Evaluation: Continued 95

Chapter 1

Introduction

1.1 Problem Description

In an age where computers in the home are considered the norm, it is not uncommon for a person to use a computer without fully understanding the mechanics of how the hardware or more importantly the software works. This means that developers these days must develop software which can be understood by all people irrelevant of their technical backgrounds by making their software simple and intuitive to use.

With the rise of personal computers and Internet to the home came, what could be considered as, a communication revolution. The Internet allowed people from all corners of the world to communicate faster than they ever could have before. The exchanging of letters could take days if not weeks meaning replies would often be outdated and possibly no longer correct. But with the Internet, via things like social media, we are able to instantly message anyone in the world who can reply in real time letting conversations flow easier and be factually correct.

Yet not everyone is sitting at their computers all day every day waiting for messages to come through or have the time to reply to all messages they maybe receiving. A solution to this issue is using a Chatbot. A Chatbot eliminates the need for human interaction and will respond to messages automatically.

Chatbots require a certain amount of technical set up including writing the code to make the Chatbot work. For the majority of computer users this an extremely difficult task as they will have no prior programming background. This project will look into creating a form of Chatbot 'set-up wizard' aimed at non-technical users which is in the form of a Chatbot itself. Users will be able to interact with the Chatbot I will create, resulting in the Chatbot

producing the code the user will require to build their own Chatbot.

1.2 Aims

Design and implement a Facebook chatbot which will interact with user's and gather requirements from them for the creation of their own chatbot. The Chatbot will take the user's requirements and produce the code they require to run to create their own Chatbot. There will be a focus on how users interact with the Chatbot and what requirements can be implemented to enhance the users experience.

1.3 Objectives

- Research key aspects of human-computer interaction to discover vital information on users preferences when interacting with artificial intelligence.
- Research existing softwares and gather an understanding of the uses of Chatbot's and the various ways of implementation.
- Develop a basic Facebook chatbot which creates the code required to create a Chatbot.
- Perform rigorous user testing using non-technical users to ensure the Chatbot performs as the user expects it to.
- Develop and integrate improvements into the software dependent on user feedback.

1.4 Initial Requirements

At the early stages of this project some direction is required from some high level requirements which, at a later stage, will become more refined and described with greater details. The following requirements are split into requirements that must be implemented and are absolute requirements, requirements that should be implemented and are recommended as they would improve user experience and requirements that are optional and may be implemented time permitting.

The Chatbot software ***must***:

- Have an intuitive interface which can be used by all types of users
- Have the ability to ask predefined questions and store information based on user's answers
- Have the ability to display all information to a user once a conversation is complete to ensure all information being stored is correct
- Return functioning code back to the user

The Chatbot software ***should***:

- Be intelligent enough to decide which predefined statement or question to send next to a user

The Chatbot software ***may***:

- Have the ability to answer questions it was not configured to answer using certain IA techniques

1.5 Summary

This section has discussed the aims of this project and the objectives that is it set to complete. The initial requirements, derived from the projects aims and objectives, gives a small snapshot of the expected solution this project will design.

The next chapter will provide an in depth review of various academic papers along with existing products. This literature review will provide me with the information I need to create a product that is not only unique but also appealing to users.

Following on from the research found in the literature review, requirements can be formed. To ensure the product is on the right tracks the research will be coupled with a preliminary user study to prove any key findings.

Once the requirements have been formulated, the design and development of the Chatbot can occur. The Chatbot that will be created will act as a proof of concept and will be tested on real users. The results from this user study will allow us to prove or disprove key findings and hypotheses in this dissertation and will enable us to decide if this is a worth project to continue with.

Finally the dissertation will conclude with discussions on the limitations faced in this dissertation, the contributions this dissertation has made and any further work. The further work will give the chance for a discussion about features that may not have been implemented but how their implementation could affect the Chatbot that is created.

Chapter 2

Literature Review

The goal of this project is to develop a Facebook based chat bot which can be used to design and construct a new chatbot. The intention of this chatbot is to provide non technical people with an easy to use platform to aid them in creating their own chatbots. Prior to the development of this chatbot research will need to be carried out in a number of areas. To begin with, exploring the history of chatbots and their perceived usefulness by users will be required to ensure this a worthwhile project to conduct.

As this project is focused on making a chatbot which will be used to chat with humans, the examination of human - chatbot interaction will be essential. This part of my research will focus on questions such as 'Would humans prefer to interact with a chatbot that is more robot or human like?' and 'What keeps humans engaged when talking with chatbots?'. This investigation will aid me in making decisions on the design of my chatbot to optimise user experience.

To prevent myself from duplication working that has already been carried out I will also be looking into existing chatbots and chatbot related products. An examination of how these pieces of software have been implemented and reviewed by users will enable me to discover what has successfully been implemented and areas which require improvements.

The conclusion of this literature review will provide me with a description of core attributes humans prefer in chatbots and a clear indication of how I should implement my software to provide a satisfying experience for the user.

2.1 What are Chatbots?

According to the Oxford English Dictionary a chatbot is "A computer program designed to simulate conversation with human users, especially over the Internet". They can also be described as software agents which use artificial intelligence and natural language processing to understand user input and provide meaningful responses.

2.2 History of Chatbots

In 1966, Joseph Weizenbaum developed what was considered as one of the first chatbots, the ELIZA program. ELIZA was written in MAD[1] -SLIP[2] and was developed with the purpose of enabling natural language communication with computers and humans possible. ELIZA was designed to imitate a psychotherapist and was implemented using basic a keyword matching technique. A user would type a statement to ELIZA using a typewriter and the system would scan the input for keywords. If a keyword was located within the input the next statement sent by ELIZA would be based off the rule associated with that keyword. If no keyword appeared with the input ELIZA would send a random statement. At the time of release, ELIZA was an advanced piece of technology and it was mentioned that some users believed they were talking to a real human therapist. As ELIZA was designed to trick humans into believing they were talking to another human ELIZA can be considered as successful.

But ELIZA was not designed to remember conversations so from this ALICE was created. Standing for Artificial Linguistic Internet Computer Entity, ALICE was implemented in 1995 by Dr. Richard S. Wallace and is an extension of ELIZA. ALICE was developed in AIML[3] and has the ability to 'learn'. The learning model of ALICE is considered as supervised as it requires a human, known as a "botmaster"[1] to continuously monitor the bots conversation and formulate new AIML content when required to create more human like responses from the bot. ALICE did not have the ability to remember conversation history but did have the ability to recall the previous topic discussed meaning when faced with an unrecognizable input from the user she would respond with something related to the previous topic. This further enhanced users experiences with chatbots as they appeared more human-like.

[1] MAD - Michigan Algorithm Decoder. A programming language and compiler developed in 1959 for IMB

[2] SLIP - Symmetric List Processor. A programming language developed in the 1960's for list processing

[3] AIML - Artificial Intelligence Markup Language

Launched in 1997 by Rollo Carpenter, Cleverbot "is one of the most popular chatbots in existence"[2]. Unlike ELIZA and ALICE, Cleverbot did not have a set of predefined phrases and response but instead learnt how to simulate natural language via its previous conversations with humans. Cleverbot was able to store all conversation history and when replying to a human would look back at this history to find a human written response to reply with. Cleverbot's unique method of responding with human like response meant that in 2011 it passed the Turing Test at the Techniche Techno-Management Festival, with 59% of people rating Cleverbot as human (Aron, 2011)[3]. Due to this accolade, Cleverbot was considered as one of the most advanced conversation chatbots with respect to its human-like natural language.

2.3 Human Interaction with Chatbots

Since the creation of the first chatbots such as ELIZA there has been a large focus on the natural language processing of chatbots. As stated in the Oxford English Dictionary, NLP is "the application of computational techniques to the analysis and synthesis of natural language and speech". Originally, early NLP involved keyword matching to allow chatbots to select an appropriate reply to the user as used by ELIZA and ALICE. Nowadays NLP is a lot more sophisticated allowing chatbots, for example, to be able to understand and process phrases it is not hard coded to know and respond to. If a chatbot was programmed to understand "Hello, please can you book me a hotel" but the user was to type "Hi, I need a hotel" NPL allows the chatbot to know that both of these phrases mean the user is in need of a hotel and can then help the user.

As suggested by A. Følstad and P. B. Brandtzæg (2017) [4] there is a need to move from the design of an interface as task of explaining to the user what is available to them and how to reach their goals to an "interpretational task" which has a goal of understanding what the user actually needs and they best way of assisting with that need. Significant research has gone into NLP over the years understandably as it gives the appearance that the chatbots are more human like but in the modern day we are faced with an age of slang, short hand language and emojis. Is it enough these days for chatbots to reply with a grammatically correct formal response? Or would users prefer to see bots using shorthand words and emojis? What else would give a user positive experience when interacting with a bot?

Hill, Randolph Ford, Farreras (2015)[2] carried out an experiment to see how humans communicate differently with the knowledge of if they are talking to a human or chatbot. To reach their conclusion Hill et al compared 100 random human to human instant message conversations and 100 random

human to Cleverbot conversations. The experiment set out to examine "the amount of written content, the uniqueness of the words used, the frequency of profane language, and the use of standard CMC[4] linguistic features such as shorthand phrases and emoticons". One discovery was that whilst humans-human messages may contain more words, humans were more likely to send a higher quantity of messages to Cleverbot. Hill et al suggests that this is due to the fact humans were modeling their communication based off of Cleverbot's i.e. using similar message lengths. Yet during human-Cleverbot exchanges it was found that humans are more likely to use negative language and convey negative emotions implying that the humans continued to remember they were in fact talking to a bot. Despite the negative language humans still hold conversations with chatbots and occasionally divulge personal issues with the bots indicating that humans do want to use bots and indeed may even trust them.

Valerie the receptionist[5] was a robot created in 2003 as part of Carnegie Mellon's Social Project and was used to explore long term human-robot interaction. Valerie was placed in the entranceway of Newell-Simon Hall and was able to provide information on various topics such as weather and directions. After analysing 9 months worth of interaction between Valerie and humans, R Gockley et al were able to conclude a number of design features in a robot for improved interaction between bots and humans. It was found that to conform with social norms humans preferred to be engaged by a greeting and to have a mechanism to end conversations such as a goodbye to indicate the end of the interaction. Another important factor that was discovered was the type of dialogue used by the bot. To maximise the human-bot interaction experience bots should limit their dialogue down to a small number of sentences as it was found that if anymore than a few lines were used, humans would lose their interest in the conversation. Limiting down the number of lines in a message from a bot also allows for natural back and forth conversation rather than it being all one sided.

Advancing on the design features R Gockley et al suggested, it was discovered by T M Holtgraves et al (2006) [6] during their research into 'Perceiving artificial social agents' another 2 important features required for humans to perceive a bot as more 'human like'. Within human conversations one of the predominant features is their politeness levels, as discussed by Holtgraves et al. They state that there are 2 types of politeness as put forward by Brown and Levinson (1987) [7], "Negative politeness (an emphasis on individual autonomy and freedom from imposition) and Positive politeness (an emphasis on closeness and communion with others)". For their first experiment, Holtgraves et al focused on positive politeness in the form of the bot occasionally

[4]Computer Mediated Communication

using the user's first name in the conversation vs a bot which never used the user's first name. It was observed that the users who spoke to the bot which occasionally used their name had a better experience than the users who spoke to the bot which did not use their name. For their second experiment, response latency was varied to examine how the users perception of the bot would change. The result of this second experiment concluded that bots with the short latency period between messages was viewed more positively and considered "more conscientious and extroverted" than the bot with the long latency. Yet processing user queries can take time meaning the potential of long latency periods is unavoidable.

The negativity towards long latency periods may be due to users need to know the bot is working on their request and not just sitting idle before replying. As discussed by Brennan (1998) [8] , in the real world humans are giving constant feedback on the progress towards their goal. In the physical world an action often has a visible result showing progression. Yet this is not always the case in the world of computers. Brennan mentions how older interfaces such as command line interfaces to operating systems such as UNIX fail to provide users with feedback. This in turn means that the users must then explicitly look up to see if the command was executed correctly. For example if a user was to use a command to save a file the user would then need to navigate to the directory in which they wanted to save the file and confirm that this action was completed. Within human-human conversation there are subtle ways of signaling that a person is thinking such as using "um's" and "uh's" so within human-bot conversations the bot should provide feedback to a user if a request takes longer than a certain period of time to complete to keep the user engaged with the chatbot.

2.4 Existing Chatbots

Through product research I have been unable to find a chatbot which can be used to create a new chatbot. But the chatbot market is currently booming with various other kinds of chat bots from instant messenger chat bots to voice controlled chat bots. Each of these different types of products will exhibit features users provide positive feedback on, from which I will be able to incorporate into the design of my chat bot.

According to a report published by Blue Corona[5] in April 2017[9], 22% of the world's population use facebook showing this a thriving platform for people to release their chatbots on. One company to take advantage of this colossal audience was Just Eat. Just Eat are a company who work with restaurants

[5] Blue Corona - an inbound web marketing, analytical and optimization company (https://www.bluecorona.com/about/ [Accessed 20/11/2017])

to provide an online delivery service to customers with a secure and simple way to order and pay for food. Back in September 2016 Just Eat release their first facebook chatbot.

This chatbot allowed users to search for and order their food. To entice more users the chatbot also had the ability to type words such as “dinner” or use emojis to prompt the chatbot to provide a list of suitable restaurants. An article[10] published by Seb Joseph for thedrum.com states that over 15,000 people have used this chatbot, with an article[11] published by marketingweek.com suggesting 13.5% of people use the chatbot again. Seb goes on to also claim that 4 in 10 people who interact with the chatbot go onto completing and purchasing an order, which is a reasonable number of people as he states that 70% of chatbots in this environment fail. Due to its relative newness, there are not many articles on why this chatbot has been successful but suggestions could be its playfulness around using and recognising emojis. Also an aim of this chatbot was to inspire people to order foods be it from their usual restaurant or somewhere new. So this suggestion mechanism to help to decide on what to have or to propose a new taste adventure to the user can help provide the user with a more smooth and enjoyable experience.

Another company that has tapped into the Facebook user market is Kayak. Kayak provide a traveling planning service to users by searching a number of different sites for the cheapest flights, hotels, car hire and holiday packages. In June 2016, Kayak released their Facebook chatbot which had the ability to search and book various things like flights and hotels. Statistics[12] gathered from Chatbottle[6] show the bots potential for popularity as within its 4th month of functioning Kayak profile page was viewed over 200 times with 80 people proceeding to go into the chatbot.

This chatbot has similar features to the Just Eat bot where it uses a suggestion mechanism to help the users decide on holiday choices. If the user was to enter something such as "Where can I go for £200" or "Where can I go for a romantic get away" the Kayak bot will suggest destinations taking away the users problem of not knowing where to go. Kayak have also implemented the understanding emojis within user queries. If a user was to enter "Where is the best place to (beer emoji)?" i.e. "Where is the best place for beer" it will show a number of destination suggestions. They have also linked certain emojis with specific places, for example if a user was to just enter the statue of Liberty the returned results will all be New York based. As stated by David Solomito who is the VP of brand marking for Kayak in North America "Now emojis are part of mainstream communication more than ever, this made sense". At the start of the conversation the bot asks

[6]Chatbottle is a search engine which can be used to search for other chatbots

to link with your profile. This is to give the user a more personalised experience, as once connected the bot can then start using the users name within conversation, which during a review[13] carried out for medium.com is a preferred attribute of a chatbot.

Chatbots are not just limited to Facebook or indeed to chat rooms. The technologies used to create these conversational bots gave way to an age of User Interface Agents and Intelligent Personal Assistants (IPA). These are pieces of software that provide assistance to a user which is personalised to them for computer related issues. The users experience was personalised by the agent learning the user's preference and tailoring their assistance to match.

One of the first and most notable user interface agents was created in 1997 by Microsoft released within their bundle called 'Clippy'. Microsoft's aim of clippy was to aid novice users in computer software use by offering advice on what they should do. If for example a user began a new document with the word 'Dear' Clippy would recognise this and would tell the user it believes they are writing a letter and offers them a list of options to aid them with letter writing e.g. templates. Users were also able to ask Clippy questions, then Clippy would refer back to the Answer Wizard and provide solutions to the users question. On paper this user interface agents sounds like a software novices best friend, but in practise Clippy was not so highly regarded. Clippy has been noted as arguably the most famous interface agent but also the most hated. As suggested by Luke Swartz (2003)[14] there are a number of reasons why Clippy failed with one reason being etiquette. As quoted by Swartz, Miller and Funk (2001)[15] suggested a set of etiquette "rules" with one of them being "Don't make the same mistake twice". This is something Clippy failed to adhere to. No matter how many times a user dismissed a certain suggestion made by Clippy he will continue to repeat it and therefore was not learning. This and Swartz research points to humans preferring to interact with an agent that learns and adheres to social conventions.

Clippy was a limited helper though as it was only able to offer help to users based on Microsoft software. This gave rise to intelligent personal assistants which have seen a surge in popularity over the last few years. Google Assistant, Siri, Cortana and Alexa are amongst some of the most well known and mainstream IPAs. These IPAs can be found built into most smart phones or as a device that you can place in your home. They use verbal communication to interact with users to complete any sort of task. If a user was to use Google Assistant for example and said "Ok Google, call my mum" or "Ok Google, how do I get to Heathrow Airport?", the Google Assistant would proceed with executing that task, with Siri and Alexa working in similar ways. A review[16] if these four technologies was carried out for businessin-

sider.com by Jeff Dunn.

This review provides a wealth of feedback on what is preferred in an IPA with some of the major points being not to overwhelm the user with too many options. When a user is being vague offering options to assist can be seen as helpful but when being asked a direct question by users, users would prefer have less options and just the result to their question. Remembering previous conversations to aid with furthering the current conversation is also a key factor. As discussed by Jeff, when asking "what is the weather going to be like tomorrow?" all IPAs were able to give some response, yet when followed up by "what about Boston" only two out of the four IPAs were able to relate that statement back to weather as where the other two required the user to state "what is the weather going to be like in Boston?". This could also be considered as natural language processing as Jeff proceeds to ask "will I need an umbrella this week?", with of which three were able to relate this statement back to weather and pull up a weather forecast. The lack of NLP can cause users to potentially remember that they are in fact talking with a bot, almost ruining the illusion of talking to a human.

2.5 How To Implement Chatbots

To create a working chatbot you would first have to write source code containing the code to create the chatbots endpoint and its method of handling messages and would therefore be required to have some level of programming knowledge. Once the source code has been created you would then have to decide how you would go about hosting the code. Once this is complete and you have linked to facebook using the various verification tokens and webhooks your chatbot would be up and running.

In a general sense the hosting of the code and linking to facebook is all done in a similar set way. But the way in which you can code your chatbot is wide open depending on what you would like your chatbot to do. There are many different types of chatbots for instance:

- A responsive chatbot: this chatbot is programmed with a set of questions/statements and answers to them. Upon the user typing in one of the predefined questions/statements the bot will reply with the related answer. No information is store, the bot just acts as a conversational bot

- A storing chatbot: this chatbot is programmed with a set of questions/statements but no answers. The bot will ask each question/statement sequentially and will always move onto the next question independent

of the users answer, unless it is a keyword to end the process for example. All answers to the questions/statements will then be saved on the chatbot owners computer for later analysis

For a non-technical person this would be a huge task. There are numerous websites out there which allow you to host code for free, all with a wealth of instructions to follow but if a non-technical user was to attempt to write code they would have to pick a language, learn the concepts of programming and the proceed to learn how to program in that language. So the set up of a chatbot seems to be limited to people who have or are willing to learn the skills required to create on.

My project is aiming to help limit the skills required to create a chatbot which user can supply information to, for example questions they would like their chatbot to ask other users, and it will write the necessary code required for their chatbot. Once the code is provided it will then begin to guide the user step by step on how to host the code and then link it to facebook. Effectively my chatbot will be a 'set up wizard' anyone can use so they can set up their own chatbot. As this chatbot is aimed at human users, my project will also be aimed at the HCI point of view by which I mean what is the best way to display information, retain users attention and appropriate language use for the target audience are but just a few examples.

2.6 Malicious Chatbots

As it is in this world good can always come with bad. With the ability to create chatbots people now do not only have the means to make a friendly, helpful chatbot but to also create malicious chatbots also known as chatterbots. These chatterbots can be used to gather personal/private information, launch phishing attacks and even spread malware. Just like non malicious chatbots, malicious bots take away the human element ifrom the process saving the human time to do something else.

The rapid growth of artificial intelligence and the work gone into researching how we can make bots more human like has only made the threat of malicious bots worse. Now that these chatterbots can be programmed to act and speak like humans, they can pose as humans and lead a user to believe they are speaking with a real human and potentially give away personal information or open up an attachment for example. They have a similar concept to phishing emails but are far more effective as the chatterbots can converse with the users and build up a relationship and gain their trust before launching their attack.

I have mentioned that AI and the research that has gone into making bots more human like now allow us to create bots that appear to be human. Appear is an important word when describing a bot to have human like qualities because of course these bots are not humans and cannot have human qualities. A bot can only imitate humans up to a certain point and this pitfall is one method of identifying between a bot and a human.

To identify a bot Floridi et al [17] suggest asking questions that require as informative answers as possible, for example 'tell me about your childhood' as it requires more than a yes/no answer. They also suggest to ask questions which require the recipient to truly understand the meaning of the question to be able to answer it, for example 'Name 3 breeds of dogs'. Another method was proposed in 1996 Loebner contest [18] of testing the recipients response to gibberish. Most bots will be programmed with a default answer to unrecognised input and this can be proven by sending 2 or more gibberish messages and observing the results. These are but just a few ways in which a human could identify if they are chatting to a bot with many more proposed by John.P.McIntire et al [19].

As the creation of malicious chatterbots is not desired, I will aim to look into ways in which I can prevent my chatbot being used to create malicious chatterbots.

2.7 Summary

My literature review has presented the discussions of different areas which will aid me in determining the scope of my project and key features to keep in mind when developing my software. The initial part of my literature review gave a brief history of chatbots which provided evidence that chatbots are not a new idea and were first implemented many years ago. Its shows that even with the lack of technology back in 1966 when Joseph Weizenbaum developed ELIZA there was a need and interest in the field of chatbots. The most important theme discovered from looking into this history was with each new chatbot developed, the human like quality increased.

This theme meant that next it was necessary to discuss how humans interact with bots and through academic research what has been found with regards to a humans preference when talking to a bot. I discussed a handful of papers each doing their own experiments which came to similar conclusions, suggesting that humans do in fact have preferences when it comes to talking with bots.

Finally I researched different types of chatbots that are already on the market. I was able to look into reviews from first hand users to see their views on the products and see what they had to offer on their ideas of the positive and negative aspects of the bot they were interacting with. To further back up the findings of the above article authors, more research will be required to relate back in findings made scholarly articles and papers.

The conclusion of my report has shown that field of chatbots is an up and coming field and is worthwhile to explore. Even though chatbots have been around for years, only now research is going into them so my project will be new work that has not been tried before. My project will involve me developing a Facebook based chatbot which users can use to create a script which they can then use to create their chatbots. As most users of Facebook mostly do not have the skills to program or in fact just have no want to learn how, they can use this chatbot to develop their own chatbot without having to know the technical details. The results of my research has shown what users prefer in a chatbot which I will be able to use when designing my software.

Chapter 3

Requirements Gathering

This chapter will look to establish the requirements of the system I am looking to make. These requirements will be derived from the research presented in the literature review and through the comparison of existing software. The requirements presented in this chapter will provide a baseline for what my chatbot should be able to do with the intention of adding requirements through user testing at a later stage.

3.1 Evolution of Requirements

By examining the results and findings of the literature review, an initial set of requirements for a Chatbot can be derived which address the HCI aspect of what humans prefer in a Chatbot. These initial set of requirements aim to provide a loose framework for a baseline Chatbot which have the basic functions a human would expect in a Chatbot and then further research by means of user testing will provide a further set of requirements.

I also conducted a small user test to identify key aspects of what users prefer what speaking with a chatbot. So the aim of this user test is not to test the functionality of the bot but to put into action some key criteria found in the literature review and see if they match with real user opinions. The test involved the users answering the following questions:

1. What is your name?
2. How old are you?
3. What is your favourite food?
4. What is your favourite film?

The users interacted with 2 different chatbots, chatbot A and chatbot B. Chatbot A is what I will refer to as a basic bot and chatbot B is what I will

refer to as a more advanced bot. The key differences between the bots we as follows:

Chatbot A

- Does not initiate the conversation
- Does not use the users first name within the conversation
- Uses only 'proper' english i.e. no slang
- Does not offer the user the chance to correct an answer only the option to start again
- Sequentially asks questions independent of the users answers
- Sends the user a file in chat containing the answers

Chatbot B

- Does initiate the conversation
- Does use the users first name within the conversation
- Does use the occasional slang and emoji
- Does offer the user the chance to correct specific answers and the chance start again
- Sequentially asks questions independent of the users answers
- Sends the user a file in chat containing the answers

Users were then asked to fill out a brief questionnaire with the following questions:

- Which chatbot did you prefer to interact with?
- Why did you prefer interacting with the chatbot you chose in question 1?
- Suggest any improvements to your preferred chatbot

3.2 Criteria to be addressed

Enhancing user experience

It is evident from the literature review and user study that to enhance a users experience whilst talking to a bot, the bot needs to appear more human like. Reducing the bot like qualities of the chabot and increasing the human like qualities will encourage potentially longer and multiple interactions with each user.

Within this section I will discuss the ways to increase the human like qualities in a bot, discovered in the literature review, leading to requirements for the system I am going to develop.

Using Natural Language Processing (NLP)

To provide an enhanced user experience it is almost intuitive to say that the bot must have the ability for NLP. The fundamental goal here is to give the bot the ability to generate answers in a more natural language and to reduce the chance of the user typing an unrecognised input. The typical keyword matching technique can either lead to the bot not understanding numerous inputs or can lead to the bot finding a response which matched to the keyword but is using the keyword out of context and therefore providing an incorrect response. Reducing the chance of the bot not understanding an input will give the bot a more human like appearance and better mimic natural human-human conversation.

Therefore my bot must implement NLP in some form. To achieve NLP in my system I will look to use the NLP method provided by Facebook. With each HTTP request to my bot, Facebook will look at the user's input and based off of a number of entities (e.g. greetings) will provide a confidence value. So the higher the confidence value the more likely the user's input falls within that entity and using a generic response for the entity will be correct.

Adhering to social norms

An easy way to decipher between a bot and a human is to identify if they are conforming with social norms. Without even thinking humans do this naturally but, unless programmed to do so, bots will not. Humans will begin a conversation with 'Hello', end with 'Goodbye' and respond with 'please' and 'thank you' when necessary amongst other things. As indicated by R Gockley et al humans prefer to speak with bots who conform with social norms.

From the results of my user study 75% users liked the fact that the chatbot initiated the conversation with some of the reason being it removed the confusion of how to start the conversation. Another theory for this result was that R Gockley et al's proposition was correct and unbeknown to the users they picked up on the fact that chatbot B was conforming to social norms and they prefered it as it provides a gateway for more natural conversation.

To ensure my bot implements social norms I will design my bot to initiate conversations with a friendly greeting, to end conversations with a form of goodbye and when it asks questions to use please and thank you. I will also ensure that my chabot provides some personal information such as its name for instance within the greeting as this was suggested in the user feedback to 'set an even friendlier tone to the conversation'.

Length of dialogue

It is easy for a person to lose concentration or interesting in a conversation if the speaker speaks/types in long sentences or monologues, as suggested by R Gockley et al. This could be due to the fact that the listener is not interested in the topic or doesn't understand what is going on. To encourage listeners to remain focused on the bot, if it was to have a lot to say, R Gockley et al proposed a more interactive storytelling mechanism where instead of just stating what it has to say, at set intervals asking the listener to indicate if they still have interest in what the bot has to say.

With my bot being aimed at non technical users and my bot itself aimed at providing technical information it is very likely that the users will become disinterested if they don't know what is going on. Therefore building on R Gockley et al I will ensure my bot speakings in short sentences, where possible, to encourage natural back and forth conversation. When my bot begins using technical terms I will offer the user the option of more information so they can choose to gain a further understanding or just move on if they are comfortable with what's going on.

Using the user's first name

As conclude in the literature review a user has an enhanced experience when a bot uses their first name within conversations compared to those which do not use the user's first name. This criterion aims to personalise the user's experience and make the bot appear more human like.

100% of users in the user test stated some form of positive comment towards the chatbot using the users name. All of the users preferred chatbot B which did use the user's first name and they suggested that a chatbot

which uses the users first name appears more human like, intelligent and it gives a more personalised experience. Backing up my findings in the literature review.

This criterion can be fulfilled by the bot simply using the user's first name within greetings, goodbye's and questions. Preferably the acquisition of the user's name will be performed by the underlying code by identifying the user interacting with the chat window. Unfortunately this action has now been blocked by facebook meaning the user's name will have to be acquired through the bot asking the user what there name is. This may not be a negative though as not all people are called by their first name so by offering the user the chance to input their own choice of name rather than pulling their name from their profile would give a more personalised experience.

Providing the user with constant updates

As suggested by Brennan (1998), humans are given constant updates in the real world and therefore if there is a long latency period between a bots replies due to processing the information for example the bot should update the user to show they are working on the answer.

Within my user study neither of the chatbots being tested implemented any form of progress update to see if Brennan (1998) was in fact right by giving the opportunity for the users to suggest it as an improvement. 50% of users suggested some form of progression indicator to show that the chatbot is working on the message and is replying.

Users will be interacting with a chat window meaning the use of things like loading wheels and progress bars cannot be applied. The solution to this problem was found by searching through the APIs made available by Facebook. To achieve this goal the bot will display three dots when typing (aka processing the message). It is common knowledge amongst social media users (technical and non technical) that these three dots represent someone type and is implying that the recipient is working to reply to their message.

3.2.1 Producing Chatbot code

The end goal of this chatbot is to have it produce the code the user requires to build their own chatbot. Within this project I have taken into consideration 2 types of chatbot:

1. A responsive chatbot: this chatbot is programmed with a set of questions/statements and answers to them. Upon the user typing in one of the predefined questions/statements the bot will reply with the related

answer. No information is store, the bot just acts as a conversational bot.

2. A storing chatbot: this chatbot is programmed with a set of questions/statements but no answers. The bot will ask each question/statement sequentially and will always move onto the next question independent of the users answer, unless it is a keyword to end the process for example. All answers to the questions/statements will then be saved on the chatbot owners computer for later analysis.

To achieve this goal there are a number of technical areas which will need to be addressed.

Creating a chatbot

To create a chatbot that produces chatbot code I will first need to develop my own bot. This bot should have the ability to ask users questions and store their answers which at a later stage should be incorporated into a piece of code which the users can then use to set up their own chatbot. At this point it is yet to be decided which language to write this underlying code it, more research will be required. This code must contain the endpoint and the methods for message handling.

Ensuring a malicious bot cannot be made

As discussed in the literature review, there is potential for people to create and use malicious bots. Looking at the types of bots by chatbot will be able to produce the concerns appear to be the ability for the bot to ask personal questions such as phone numbers or even bank details and then store that information. The user typing in this information may be assumed to be naive and input this information without realising the information is being store and once stored this information cannot be accessed again by the user.

As there is a vast number of ways in which a malicious bot could be made using some form of keyword matching would be difficult as not all keywords could be predicted and therefore allowing the creation of a malicious bot. To overcome this I will ensure that I hardcore in warnings that this bot will store any information that is typed in and that it will not be accessible again once submitted. As this bot is aimed at non technical people it is assuming they will not understand the code and will therefore not be able to remove the warning.

Transmission of answers

Once the user complete's their interaction with my chatbot will send them their unique code, containing their answers, which can be run to create their own chatbot. During my user testing I did not return code back to the users but instead return a file containing the answers to their question so that the functionality is the same, just different data is sent.

It was suggested by 25% of the users that the data should not be send to users in a file but in the chat itself as it is slightly more time consuming to go an find the file once it has been downloaded.

Unfortunately this will not be possible as Facebook has set a character count on chatbot messages and the code base code which eventually contains the users answers already exceeds the character count before I even add in the users answers. I was looking at potentially spreading the code across multiple messages but this ruins the format of the code, which is important when running python, and looks confusing and messy. So for my chatbot I will be sending the underlying code in a file send within the chat.

3.3 Requirements

Below is a table containing the initial requirements for my baseline chatbot which will be used in my user testing and will allow for the indication of the success of the primary goal of this project.Each requirement will have a priority rating from 1 to 5 where a priority of 1 means the this requirement must be implemented and 5 means this requirement would be a nice addition but is not essential to this project progressing.

3.3.1 Functional Requirements

FR: 1
Requirement: The system must be able to process messages in the form of HTTP requests
Description: Messages will be sent to my bot in the form of HTTP requests and will therefore need to be able to process these requests in order to reply to the user
Priority: 1
Priority reasoning: Without the ability to process HTTP requests my chatbot will not be able to function and reply to the user
Source: Facebook Chatbot building technical specification

FR: 2
Requirement: The system must be able to initiate a conversation with a user
Description: As identified by the preliminary user study, having the chatbot initiate conversation removed the users confusion of how to begin a conversation with the chatbot
Priority: 2
Priority reasoning: If a user is confused as to how to begin a conversation with my chatbot they may not engage in conversation with my chatbot at all
Source: User study

FR: 3
Requirement: The system should begin and end conversations with a greeting
Description: Adhering to social norms such as using greetings has shown to give a more positive user experience and to give the appearance of a more human like agent
Priority: 4
Priority reasoning: This is key to improving user experience but does not affect the functioning of the Chatbot
Source: Literature review and user test

FR: 4
Requirement: The system should use the users name within the conversation
Description: Adhering to social norms such as using people's names within conversations has shown to give a more positive, personalised user experience and to give the appearance of a more human like agent
Priority: 4
Priority reasoning: This is key to improving user experience but does not affect the functioning of the Chatbot
Source: Literature review and user test

FR: 5
Requirement: The system should have the ability for natural language processing
Description: Reducing the chance of the bot not understanding an input will give the bot a more human like appearance and better mimic natural human-human conversation
Priority: 3
Priority reasoning: This is will aid in reducing the number of potential unrecognised inputs giving the chatbot a higher reply success rate. But with

clear and concise instructions from the chatbot, not having NLP should not affect the user massively
Source: Literature review

FR: 6
Requirement: The system should ask the user if it should continue if it needs to speak in more than 2 sentences
Description: To maintain users attention
Priority: 4
Priority reasoning: This is key to improving user experience but does not affect the functioning of the Chatbot
Source: Literature review

FR: 7
Requirement: The system should offer the option of more information to the user when using technical terms
Description: Allows for the user to understand what the chatbot is talking about and the technical background of building a chatbot if they wish to learn
Priority: 3
Priority reasoning: As the this chatbots target audience is non-technical users this will aid in their understanding of what is going on but it does not affect the functioning of the Chatbot
Source: Project description

FR: 8
Requirement: The system must provide progress updates to the user when processing and replying to a message
Description: Allows the user to see that the chatbot is working on their request and is not sitting idle doing nothing
Priority: 3
Priority reasoning: If the system takes longer than deemed necessary by the user to respond to a request and does not inform the user that it is still working the user may leave under the impression that the chatbot is potentially broken and/or not doing anything
Source: Literature review and user study

FR: 9
Requirement: The system must have the ability to ask questions sequentially
Description: Allows the chatbot to construct conversation with the user, responding with certain statements depending on the user's input
Priority: 1
Priority reasoning: If the chatbot cannot ask questions in the correct order the conversation would not make sense to the user, making the task they

need to complete difficult
Source: Project description

FR: 10
Requirement: The system must be able to store the user's responses
Description: The answers that the user gives are then used to insert into a piece of code which they will be able to run to set up their own chatbot
Priority: 1
Priority reasoning: If the chatbot is not able to store the appropriate answers from the user it will not have no information to insert into the template code
Source: Project description

FR: 11
Requirement: The system must have the ability to insert the user's answers into a template piece of code
Description: Allows for the creation of the chatbot code for the user
Priority: 1
Priority reasoning: If the system cannot insert the users answer into the code then the chatbot would return non-functioning code
Source: Project description

FR: 12
Requirement: The system must inform users that it will be accessing their public information from their profile (e.g their name) and that it will be storing their answers **Description**: Allows for users to protect their information if they do not which for it to be accessed or saved
Priority: 1
Priority reasoning: The user has a right to know if their personal information is being used and stored
Source:

FR: 13
Requirement: The system should display any information its storing back to the user and offer them the opportunity to correct any of their inputs
Description: Allows for the assurance that the information being stored is correct and allows the user to remove an information which they may have entered but then decided they do not wish for that information to be stored or used
Priority: 1
Priority reasoning: If incorrect information is stored and then inserted into the template code it will produce a chatbot that does not align with the users expectations
Source:

FR: 14
Requirement: The system should encourage the user to try another input if it is unable to process a users input
Description: Allows for the user to understand that the chatbot does not understand what they have said and should try saying it in a different way
Priority: 2
Priority reasoning: If the user was to input unrecognised input into the chatbot and it did not respond the user may assume that the chatbot is not functioning and fail to proceed with the process
Source:

FR: 15
Requirement: The system must not allow for the creation of malicious chatbots
Description: Users have the ability to create a chatbot which stores users responses meaning once stored the chatbot owner can use that information in anyway they want
Priority: 1
Priority reasoning: To prevent users submitting sensitive information or any information that could be used in a malicious way
Source: Literature review

3.3.2 User Requirements

UR: 16
Requirement: The user must not require prior experience or knowledge about building chatbots
Description: The user should be able to complete the task with no prior knowledge of how to build a chatbot
Priority: 1
Priority reasoning: If the user must have prior knowledge of how to create a chatbot this restricts the target audience
Source:

UR: 17
Requirement: The user must not have had experience with the chosen chatbot builders
Description: The user must not have experience with either tools they are given to use in the user study
Priority: 1
Priority reasoning: If the user has experience with either tools it will provide them with an unfair advantage and they may have bias towards the tool they have used tainting their results

Source:

UR: 18
Requirement: The user must have basic computer skills
Description: The user is required to input data via a keyboard and navigate various websites to complete the user study
Priority: 1
Priority reasoning: Without these basic skills the user will not be able to complete the user test
Source:

3.3.3 Usability Requirements

UR: 19
Requirement: The system must tell the use what they are required to do to move to the next step
Description: Stating keywords for the user to use to complete a task will enable them to reach their end goals quicker and easier
Priority: 2
Priority reasoning: If the system requires a keyword to complete a certain task and the user is not informed they may not be able to move onto the next step and abandon the task
Source: Research

Chapter 4

Design

4.1 Introduction

Following on from the requirements documentation, a basic design layout can be formulated for the creation of my Facebook Chatbot.

This section will discuss the various iterations completed to reach the final product used for the user test, the high level architecture of the Chatbot and fundamental design decision which were made. End users were consulted during the design process to ensure the end product was aligning with their expectations.

The requirements section laid out a vast number of requirements for my system, all of which may ultimately be implemented to create a complete system, but to implement them all immediately within my current time constraint would not be possible. Therefore I will be focusing on implementing the requirements which make my system unique, namely the ability for a Facebook Chatbot to produce code contain user input required to make a new chatbot. Testing this unique feature will give me a good indication if this system has a place in the market and if work should continue on implementing all current and future requirements.

4.2 Iterations

To prevent myself from overloading my system with features and potentially not having a working end product in my given time scale I decided to work in iterations. The first iterations would allow for a working base product to be created and from then on each iteration would add new functionality but would ensure a working product was produced at the end. This form of Agile methodology allows for flexibility in the case of time and addition of features. To create my system I completed the following iterations.

1. To demonstrate the workflow of my bot I initially decided to write a java program which executed the functionality I intended my bot to do. There was no technical reasoning behind the choice of java, it was just a language I was familiar with. This program was written to decide how I would like my bot to function using user input from the command line. The basic requirements for my bot included the ability to ask the user questions, take their answers and return the code the user requires to set up their own chatbot so this is what I proceeded to implement.

   A key aspect I considered whilst design this program was giving the user clear instructions, feedback and ensuring they could change their answers with ease. If the user is required to enter a specific keyword to complete a specific task such as ending the process I placed the keyword within the message I was sending them to ensure they knew what to type depending on how they would like to proceed. As things like case sensitivity is different in each application I ensured that it doesn't matter in mine by taking the user input and forcing all the characters to lowercase. That meant when the keyword matching occurred within my program I could guarantee that I would be comparing lowercase text. This also allows for the illusion of a more intelligent bot as, assuming the spelling is correct, the capitalization of the text does not matter from the user perspective.

   Building upon Brennan's (1998) discussion of providing feedback to the user I decided to constantly update the users by providing them with the input they've just entered to ensure that it is correct. This allows the user to update the question if its wrong instead of having to complete the process and then start again because they typed something in wrong for example. Once the user has confirmed they are happy with everything they have typed the code they require to set up their own bot is printed to the screen for them to copy and paste.

2. I converted the basic java program into a program that can be used to interact with Facebook. To begin with I decided upon python to be the language I was going to write my underlying code in. This decision was made due to a number of reasons including:

   - The extensive range of open source libraries available for chatbots
   - Has simple syntax which aids quick development of the chatbot
   - Supports the artificial intelligence markup language which is widely used in artificial intelligence
   - It is platform independent making code migrations simple and quick.

As my bot is web based I also had to decide upon the web framework I was going to use alongside python. I chose to use Flask over its main competitor Django because Flask is more lightweight than Django, its aimed more at smaller applications and it's simplicity allows for quick development.

To create the underlying code of my bot I began translating the parts of my python program, which required the users to use the command line, into code which would instead require users to use a facebook chat window. Whilst doing this translation I realised that the logic of my program would need to change as my current program would run until the point it would wait for user input, take the user input and then continue but this was not the case when incorporating the web aspect. Flask doesn't support this kind of back and forth, almost conversation like, approach but instead will 'GET' the users input and process that one message. Once that message is processed the program will end and the state of the program forgotten. So Flask works on one HTTPS request at a time, processes it, exits the program and 'waits' for the next request.

This meant if I had a list of sequential questions my program could not ask a question, wait for a reply and move onto the next question as the program would exit after the first question and when the response is sent begin again on the first question as the program couldn't remember its state. So I had to decide how to store the state. Storing the state meant I could keep track of the user's responses and then finally input the appropriate responses into the template code which the users could then run to create their own chatbot.

3. The final iteration focused on the HCI aspect of the bot and implementing the more 'cosmetic' requirements to improve the users experience. To create an simpler and easier process for then end users I incorporated buttons into my Chatbot. Using the buttons meant that the user was required to type less, speeding up the process, and lowered the chance of the user inputting incorrect information. I aimed to have my Chatbot create a more personalised experience for the user by incorporating the users first names into conversations. I also ensured that the Chatbot adhered to social norms by starting conversations and ending conversations with greetings.

4.3 System Architecture

To understand how an interaction was to be executed from start to finish I designed a high level abstraction of the system. This will show the various different process and interaction occurring within the system. The architecture can be used to describe 3 stages:

1. Collect user input - Retrieving the users input from the JSON sent from Facebook

2. Process message - Executing some task based upon the users input and replying with the appropriate response

3. Return the completed code to the user and returning the code to the user - Once the user has entered all the information they needed to, the system must insert that information into a template code for a Chatbot. A file should be then sent to the user containing the code they require to run to set up their own Chatbot

Abstracting the systems goal into 3 stages allows for the modification of one stage without affecting the other stages. This reduces the complexity of maintaining the system. Below outlines how each of the stages are expected to work.

Collecting user input

User input will be sent from Facebook in the form of JSON (example in Figure 2). First we must ensure that we are dealing with a GET request, so user input, and once we have established it is a GET request the message can be extracted from the JSON. Once the message has been extracted from the JSON it can be passed to the method used from message processing.

Process message

Once extracted from the JSON the system must decide what to reply with. This stage will be executed by using the keyword matching method. If the input contains a keyword and a match occurs, the code associated with that word will be executed and a response will be sent back to the user.

Inserting users responses into template code and returning the code to the user

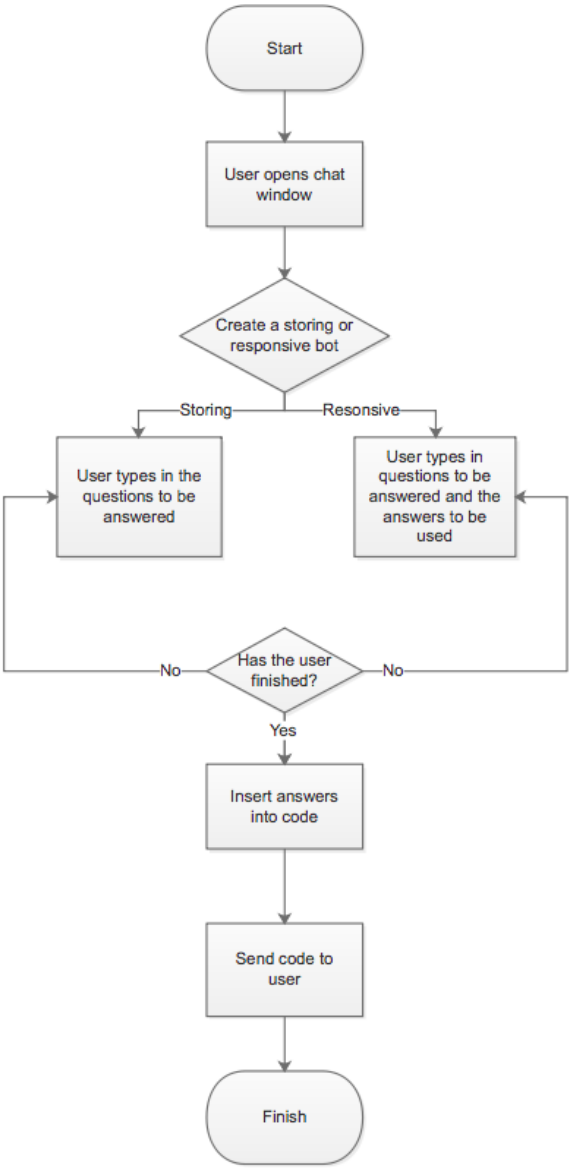
Once the user has decided they have entered in all of the information they deemed necessary the system must add this into template code. This will be done by storing the users input in a file. When the user is ready to end the

Figure 4.1: Figure 1 JSON request from Facebook which requires processing to retrieve the message


```
{
    "object": "page",
    "entry": [
        {
            "id": "177531849650265",
            "time": 1524747753532,
            "messaging": [
                {
                    "sender": {
                        "id": "1590369034416064"
                    },
                    "recipient": {
                        "id": "177531849650265"
                    },
                    "timestamp": 1524747545441,
                    "message": {
                        "mid": "mid.$cAAChdpSIgx9pM05zYVjAgkrGtfWR",
                        "seq": 334706,
                        "text": "Hello",
                        "nlp": {
                            "entities": {
                                "greetings": [
                                    {
                                        "confidence": 0.99983274937032,
                                        "value": "true"
                                    }
                                ]
                            }
                        }
                    }
                }
            ]
        }
    ]
}
```


system will read in the template code and when it comes across the keyword insert, it will copy the contents of the file storing the users data and paste it into the area indicated by the insert in the template file. A copy of the template code containing the users information is then sent to the user in the chat window.

Figure 4.2: Figure 2 Diagram to show flow of control within the system.



Chapter 5

Testing

5.1 Introduction

This section outlines the user testing carried out to confirm if the system I have created has satisfied the system requirements and the goal of this project. To achieve this the newly created system was compared with a 3rd party tool which can be used for creating chatbots. Each participant had to carry out a number of tasks in set periods of time and answer questionnaires based on their experiences.

5.2 Hypothese

Given the key findings from the literature review and preliminary user test and the aim of the project, several hypotheses can be formed. The user test will aim to prove or disprove the following hypotheses:

5.2.1 Task Success Rate

This will aim to show if users have a higher task success rate and are able to complete the task quicker using the Facebook chatbot created as part of this project vs the third party tool.

H1 Users achieve an increased task success rate using the Facebook chatbot

It is anticipated that users will achieve a higher task success rate using the Facebook chatbot. By using clear and non technical instructions the users should be guide guided to success.

H2 Users will successfully complete each task in a shorted space of time using the Facebook chatbot

It is anticipated that the users will complete each task in a shorted space of time using the Facebook chatbot. This is because the chatbot explicitly guides users from one step to the next leaving them little room to stray from the correct path.

H3 Users will attempt to search for help to aid with task completion less using the Facebook chatbot

It is anticipated that the users will attempt to search for help or technical word definitions less using the Facebook chatbot. This is because the chatbot explicitly guides users from one step to the next and using simple terms that a user of any background can understand.

5.2.2 User Experience

This will aim to show that users have an improved user experience when using the Facebook chatbot.

H4 Users will complete the tasks feeling more positive when using the Facebook chatbot

It is anticipated that users will come away with more positive feelings after completing the user study when using the Facebook chatbot. This is expected because the Facebook chatbot has incorporated various findings from the literature review such as using the users first name and greetings within conversations. It has also been designed so that the process is simple and quick to complete to prevent confusion and frustration about not being able to complete the process.

H5 Users will preferer to use the Facebook chatbot again in the future

It is anticipated that when a user is asked which tool they would use again in the future it will be the Facebook chatbot. This is expected because the chatbot incorporates may findings from the literature review which improves user experience and will therefore increase the chances of them using the tool again.

5.3 User Test

5.3.1 Demographics

8 participant undertook this user study, 3 female and 5 male, all undergraduates from varying degrees. The students were picked based on their limited technical understanding, especially their knowledge on programming and building chatbots. These students provided as ideal testers as they would satisfy the following aspects of the project:

- Being able to create a chatbot with no prior knowledge of how to
- Being able to learn and understand the process of building a chatbot

5.3.2 Materials

Consent forms (Appendix B.1) were provided to each of the participants outlining what will be required of them, how I will be using their answers in my dissertation and how their anonymity will be maintained. This consent form gave the participants an idea what was going to happen and the option to withdraw if they so wished.

Study Guides (Appendix B.2) were issued to each participant before the start of the test. It provided a step by step guide on the requirements that required satisfying to complete each task. It also outlined the time limit for each task. Most importantly the guide did not provide any instructions on how to use either tool presented to the participants.

Questionnaires (Appendix B.3, B.6 and B.8) in the form of 3 Google forms were provided to the participants at various intervals during the test. Each participant was required to fill out 4 short questionnaires. Numbers were used to identify each users answers instead of names to ensure anonymity. The questionnaires aimed to capture information such as the users experience with each product, how they rate the products against each other and improvements they would make to the products.

The *Facebook chatbot* that had been designed to create chatbots. This is the primary tool which has been developed as part of this project and the usability information gathered on this tool will help further research on this project. The participants will use this to complete various tasks within the user test and no information will be given on how to use it.

Chatfuel is a third party tool which can be used to create chatbots. This tool will be used to form a comparison with the tool created as part of this project. This comparison will show if the tool created as part of this project

is giving an enhanced user experience over what is already out on the market. The participants will use this to complete various tasks within the user test and no information will be given on how to use it.

5.3.3 Design

The aim of this user test is to reflect the usability of the system I have created and how using the system makes users feel. To indicate my system's usability a comparative test was decided upon, using my system and a 3rd party chatbot making tool called Chatfuel. Task 1 and Task 2 were comprised of the same set of instructions, to create a chatbot that asks a specified list of questions to the user and stores their results (Appendix B2), as this allowed for a direct comparison of usability. After each of Task 1 and Task 2 were completed, the participant was required complete questionnaires which also comprised of the same questions so a comparison between the two systems could be made.

To capture the results an interpretation of Brookes (1996) [20] System Usability Scale (SUS) was used. Brookes SUS was originally a set of 10 questions which used a Likert scale to capture the usability of a system. The interpretation used also used a Likert scale ranging from strongly agree to neutral to strongly disagree but instead of using the original set of 10 questions, a number of different questions more appropriate to the test in hand were used. After each Likert scale was a free form answer box to give the participant the option to expand on their answer and offer reasoning.

Once Task 1 and Task 2 had been completed the participants were asking to complete a questionnaire which aimed to discover which of the two tools the participants preferred and why. Finally the users were asked to complete Task 3 which comprised of the users having to create a chatbot that could complete a specific task (Appendix B.2). Half of the participants used the Facebook chatbot to complete the task and half of the participants used Chatfuel to complete the task. After the completion of Task 3, participants were required to complete one final questionnaire which aimed to gather specifics about what the participant liked about the tool, disliked about the tool and potential improvements.

5.3.4 Procedure

Each participant carried out the entirety of the user test individually in areas which were quiet and free from distraction. To begin with each participant was given the consent form to read through and time to ask any question if they had any. Before signing I would briefly reiterate the outline of the study to ensure they understood what they were partaking in. Once the

participant had signed the consent form they were provided with a laptop which was all set up to enable the users to complete the test. The users were then given the user guide and given a chance to read through it and ask for any clarification if they required it.

Once comfortable and ready the participant could proceed with the test and the timer would be started. Each task had a time limit of 15 minutes and the completion of a task could be signified by the user stating they believe they have completed the task or by the end of 15 minutes. During the each 15 minute task the participants were observed and notes were taken any interesting observations.

At the end of each task the participants were required to fill out a questionnaire and one comparison questionnaire after Task 1 and Task 2 were completed. Whilst the participants were filling out the questionnaires, their chatbots would be set up so that they can be tested by the participants to see if they believe they have correctly completed the task and by the evaluator to see if they have indeed completed the task correctly. Once the final questionnaire had been complete the participant will have completed the user test and informed they are free to leave the testing area.

5.4 Results

The user test seeked to gain users opinions on key aspects such as usability against the requirements that have been implemented. Not all requirements were implemented as part of this project due to reasons such as they were not deemed necessary for the user test or due to complexity and time constraints they were not able to be implemented.This section aims to outline the key findings of the user study and will attempt to provide explanations of themes discovered. For all of the raw data and response please see the appendices which will include all of the participants questionnaire answers.

5.4.1 Completion rates

Two key findings discovered during the user test was the completion time of each task and the number of tests successfully completed. Each participant was asked to complete the same task using the Facebook chatbot and using Chatfuel. Out of the 8 participants, all 8 participants managed to successfully complete the tasks using the Facebook chatbot yet only 1 participant was able to successfully complete the tasks using Chatfuel. Users found that Chatfuel was lacking 'clear instructions' and found it difficult to know where to start. The implementation of requirements ***FR2***, ***UR17*** and ***UR20*** meant that the Facebook chatbot did not face these issues, making the processes obviously easier for the user.

The participant who successfully completed the tasks using Chatfuel was able to complete the tasks in an average of 12.06 minutes as where all 8 participants were able to complete the tasks on the Facebook chatbot, on average, in 5 minutes. As you can see in Figure 4 all the participants were able to complete the task using the Facebook chatbot in under 10 minutes This could be owing to the fact that users found the facebook chatbot easier to use as 'there was no room to deviate as the chatbot would lead you onto the next step of the process'.

Therefore we have sufficient evidence to say that we have proved and accept hypothesis H1 'Users achieve an increased task success rate using the Facebook chatbot' and ***H2*** *'Users will successfully complete each task in a shorted space of time using the Facebook chatbot'.*

Reviewing the completion time of those participants who used the Facebook chatbot for both Task 1 and Task 3 (Figure 5) shows that the time taken to complete the tasks decreases the second time they use it as where the results for Chatfuel remain the same with only 1 participant being able to complete the task. This suggests that it easy to remember how the Facebook chatbot works meaning less time is spent thinking what to do as the users already know what they are doing.

Figure 5.1: Figure 3: The time take to complete Task 1 and Task 2 in minutes. 15 minutes marks that the user did not finish.

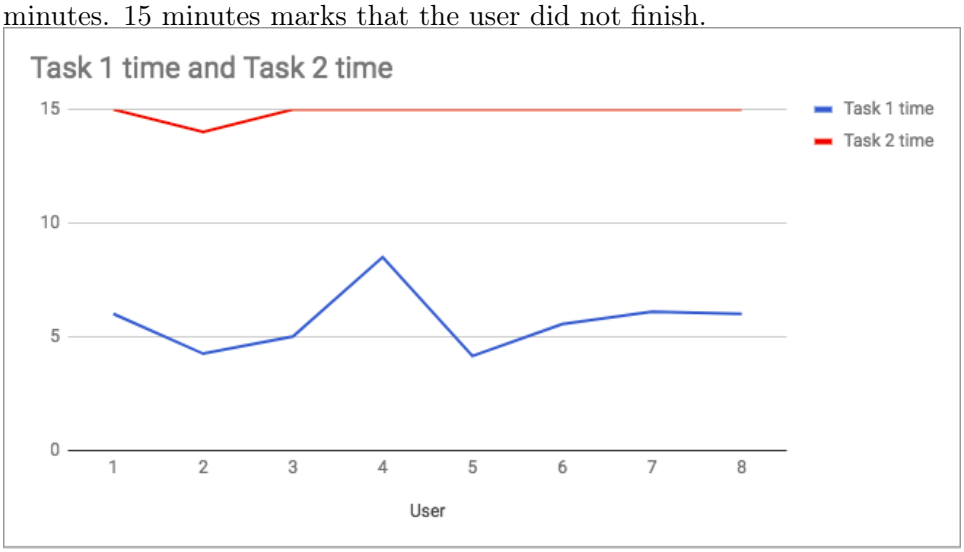
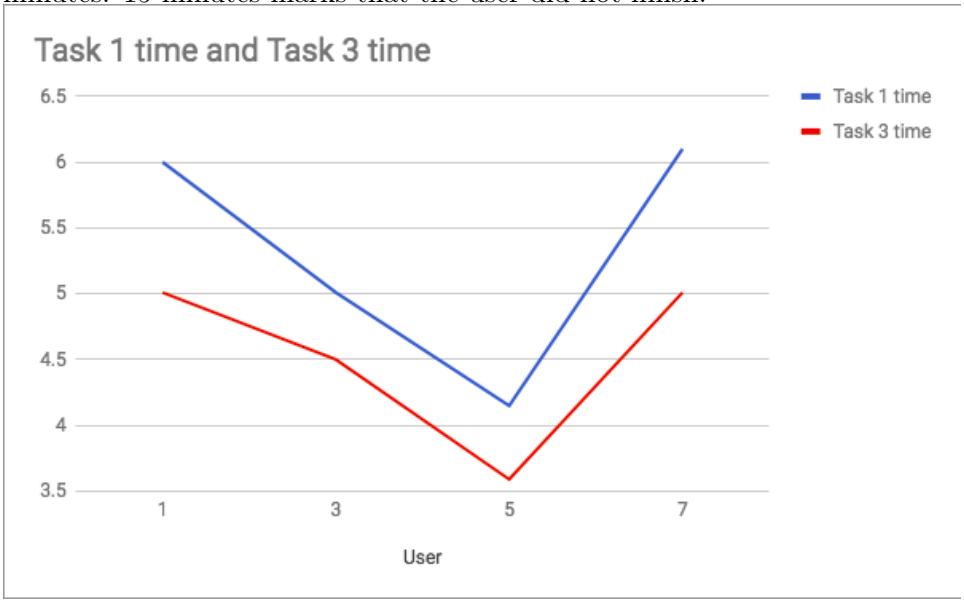


Figure 5.2: Figure 4: The time take to complete Task 1 and Task 2 in minutes. 15 minutes marks that the user did not finish.



5.4.2 Usability

One aim of this project was to explore what features would enhance the users experience when interacting with a form of intelligent agent. A key aspect was making sure that the chatbot was easy to use and could be used by people with non technical backgrounds. Various requirements were derived in an attempt to fulfil this goal and tested within the user test to confirm the findings which the requirements were derived from.

When asked, 100% of the participants agreed that the Facebook chatbot created a chatbot closest to their expectations. 100% of the participants also agreed that the Facebook chatbot was their preferred tool. Out of the 4 participants that completed task 3 using the Facebook chatbot 100% said they would use the tool again and out of the 4 participants that completed task 3 using Chatfuel 100% said they would not use this tool again. All 8 participants were from non technical backgrounds and 100% of them strongly agreeing or agreeing that people with little to no technical background could use the Facebook chatbot and strongly disagreeing or disagreeing that further instructions/support would be need to use this tool.

The results from the user test prove that that the process is easy to follow and complete as all users were able to create a chatbot that aligned with their expectations when using the Facebook chatbot compare to chatfuel. Users were also in complete agreement that the Facebook chatbot would

require little to no technical background to complete this tool. These findings also provide sufficient evidence to say that we have proved and accept hypothesis ***H6*** *'Users will preferer to use the Facebook chatbot again in the future'.*

5.5 Key Findings Related to System Design

Within the literature review many key aspects of human computer interaction were discussed alongside existing bots/chatbots and existing chatbot building tools. Part of this project aimed to build upon the findings of the literature review and either improve on them or prove that they are in face true. This section will discuss the key findings from the results of the users study which relate back to key design decision, developed from findings in the literature review and the preliminary user study, proving or disproving if they were necessary.

The preliminary user study confirmed a number of findings from the literature review which were not specifically tested again within the main user study. Most of these findings were related to the human computer interaction aspect and can be found in high level details within chapter 3 or in low level detail within Appendix A.2. Yet unintentionally they were proven again within the participants questionnaire answers.

When interacting with Chatfuel many users were frustrated as they were unsure of how to start with one user commenting 'I didn't know what to do. It did not explain where to start'. Conversely, when interacting with the Facebook chatbot users mentioned 'As it starts the conversation with you there's no confusion on how to start the process'. This backs up the point made by R Gockley et al that humans prefer bots to conform with social norms and start conversations along with the result found in the preliminary user study that by starting the conversation the confusion of how to start is removed. This proves that requirement ***FR2*** is an important requirement and potentially its requires a priority change from 2 to 1 due to the ability of this requirement to remove confusion and ease the process for users.

Another finding from the literature review and preliminary user study was that chatbots which use the users first name within the conversation appears to be more intelligent and human like. These traits appealed to users and gave the users an enhanced user experience. This point was further reinforced during the main user study. When asked 'How did using this tool make you feel and please explain your answer' users claimed to be 'intrigued' and surprised at the use of their names in conversation and how it was in fact implemented. Both of these emotions were conveyed in a their positive forms,

which again shows that using the user's first name within conversation can provide a more positive and enhanced user experience. The implementation of requirement ***FR4*** allowed for this functionality to occur and the results of the user study prove that it is a necessary requirement to implement to provide users with a more enjoyable experience.

One of the major aims of this project was to produce something that was very simple and easy to use. So usability is a very important aspect to analyses. A crucial theme that is clear throughout the participant's responses was the layout of the tool they were using. When speaking about Chafuel participants claimed that the tool was 'confusingly laid out' and 'advanced features were hidden' leading participants to fail at completing the given tasks and leaving them feeling 'confused as the layout of the website was not easy to follow', 'angry' and 'sad' because they were unable to complete the tasks. The Facebook chatbot was designed to lead users through the process step by step and ensure everything they need was in the chat window for them to see. This appeared to have the desired effect of creating a simple and easy to use tool as users claimed that the Facebook chatbot was 'laid out in nice steps so it was difficult to go wrong', 'easy to follow' and had a 'familiar layout of a chat [which] reduced the complications that Chatfuel had of navigating lots of different web pages'. The interpretation and implementation of requirements ***FR9***, ***UR17***, ***UR18*** and ***UR20*** meant that a simplistic design was implemented, providing instructions on how the user should proceed.

Another theme, which aids in proving that the Facebook chatbot is very simple and easy to use, was the users need for instructions or further explanations to help them use the tool. After completing task 2, 100% of the participants either agreed or strongly agreed that they would require further instructions/support to create a Facebook chatbot using Chatfuel. This was further reinforced with the majority of the feedback from participants when using Chatfuel was the need for instructions with 100% of the participants who used Chatfuel for task 3 saying that the major improvement for this tool would be instructions or some form of tutorial to begin with. As where 100% of participants stated that they either disagreed or strongly disagreed that they would require further instructions/support to create a Facebook chatbot using the Facebook chatbot. The participants further reiterated this within the commentions mentioning that the Facebook chatbot had 'straight forward instructions' and that 'the instructions were easy to follow and understand'. This is also backed up by the task completion statistics stated above. Requirements ***FR7***, ***UR17*** and ***UR18*** ensured that the system was designed with non-technical users in mind and drove the design to include extra options of keyword explanation and process explanation. It is reasonable to suggest that the priority of ***FR7*** should be increased from 3 to 2 as

this requirements current priority suggests that it may not be necessary to implement it. Yet these results have proven that clear instructions and extra help options create for an easier to use tool for people of all backgrounds and allow for a high completion rate indicating it is a required feature which must be implemented.

This project did not just aim to create a tool which is simple to use and can be used by anyone independent of their background, but to also provide a platform to learn more about the chatbot making process. To achieve this, the Facebook chatbot would offer the option for a user to learn more at the end if they so wished. Out of the 8 participants, only 1 agreed that they understood the chatbot making process slightly better than they did before they started. They mentioned this was owing to the page they were directed to to learn more but the page was not detailed enough so they learnt slightly more but not enough to go and build their own bot. The remaining 7 participants were either neutral or disagreed that they understood the chatbot making process better and this is due to users not clicking on the more information button. In retrospect most of them recognised that the option was there and that there was the potential to learn more but as it was not mentioned as part of the task the participants decided to not click on it. These results show that requirement ***FR16*** was loosely implemented but that it is not a particularly required requirement. With only 1 person clicking on the more information button it shows that users did not necessarily have the desire to learn more and that potentially they do not need to learn more as the Facebook chatbot provides them with everything they need to create a chatbot so they don't have to do it themselves. Therefore I do not believe we can say if we succeeded or failed in implementing this requirement because if reading the more information was part of the task then the participants would have clicked on it and could of have potentially learnt more. What we can say was that we were more successful than Chatfuel in offering the option to learn more with 100% of the participants either disagreeing or strongly disagreeing that they did not understand the chatbot making process better and this was due to the fact that there was no option to learn more.

An extensive list of the requirements and if they have been met along with supporting evidence can be found in Appendix C.

5.5.1 Summary

The user test has provided clear evidence that the Facebook chatbot is the preferred tool over Chatfuel. Users were able to successfully complete tasks and complete them in a faster time frame when using the Facebook Chatbot and it also provided a better user experience.

These are the key findings from the users study. The next chapter will look at analysing the objectives and hypotheses of the project and any improvements that could be made to the system.

Chapter 6

Discussion and Conclusion

This final section aims to discuss the objectives and hypotheses of this project, limitations to this project, project improvements and any contributions this project may have made. It will also outline some future work and propose various other interesting topics to investigate.

6.1 Objectives and hypotheses

As discussed above, the user study has help to prove some key findings from the literature review, prove hypotheses and has helped to prove that some of the mentioned objects in chapter 1 have been met. To determine the success of the project, below will be listed the projects objectives and hypotheses and evidence they have been met or proven.

- *Research key aspects of human-computer interaction to discover vital information on users preferences when interacting with artificial intelligence* - Chapter 2, Literature review, discuss key findings in the field of human computer interaction. These findings were then tested with in the preliminary user study in Chapter 4, Requirements gathering.
- *Research existing softwares and gather an understanding of the uses of Chatbots and the various ways of implementation* - Chapter 2, Literature review, discusses a large amount of research that has been published in this field and various existing products.
- *Develop a basic Facebook chatbot which creates code required to create a chatbot* - Chapter 5, Design, outlines the basic Facebook chatbot that was developed as part of this project.
- *Perform rigorous user testing using non-technical users to ensure the Facebook chatbot performs as the user expect it to* - Chapter 6, Testing,

discusses the user test that was undertaking and the results that were produced

- *Develop and integrate improvements into the software dependent on user feedback* - Chapter 4, Requirements gathering, discusses a preliminary user test which identified key features that users like. These key features were then integrated into the Facebook chatbot for the main user study.

- *H1 Users achieve an increased task success rate using the Facebook chatbo*t - 100% of users completed all tasks using the Facebook chatbot. Conversely only 13% (1 out of the 8 participants) was able to complete all task using Chatfuel. Therefore we have sufficient evidence to say we have proven and accept this hypothesis.

- *H2 Users will successfully complete each task in a shorter space of time using the Facebook chatbot* - The majority of participants failed to complete the tasks using Chatfuel and the one participant who was successful took on average 12.06 minutes to complete the tasks. Yet when using the Facebook chatbot, participants were able to complete the task on average in 5 minutes. Therefore we have sufficient evidence to say we have proven and accept this hypothesis.

- *H3 Users will attempt to search for help to aid with task completion less using the Facebook chatbot* - As discussed in Chapter 7, users stated they were more confused and could not figure out how to even begin due to lack of instructions when using Chatfuel. As where they were a lot more positive towards the Facebook chatbot mentioning it was simple to follow and that they wouldn't need any further instructions/support to use the tool. By interpreting these results we can see that users attempted to look for instructions in Chatfuel, couldn't find any and eventually ran out of time. But with the Facebook chatbot there was no need to go searching for instructions. Therefore we have sufficient evidence to say we have proven and accepted this hypothesis.

- *H4 Users will feel more positive after using the Facebook chatbot* - After the completion of task 3 users were asked how using the tool they were given made them feel. The 4 participants that used Chatfuel all mention negative feelings including confusion, anger and frustration. As where the 4 participants that used the Facebook chatbot all mentioned positive feelings including happiness, excitement and satisfaction. Therefore we have sufficient evidence to say we have proven and accepted this hypothesis.

- *H5 Users will prefer to use the Facebook chatbot again in the future* - After the completion of task 1 and task 2 users were asked which

tool would they use if they were going to create a Facebook chatbot in the future. Out of the 8 participants 1 selected neither as they felt that both products has 'flaws', but the remaining 7 participants chose to use the Facebook chatbot again. Meaning no participants would chose to use Chatfuel again. This is reiterated by the results from the questionnaire following task 3. Users were asked if they would use the tool they were given again? 100% of the participants that used the Facebook chatbot said they would use it again and 100% of the participants that used Chatfuel said they would not use this tool again. Therefore we have sufficient evidence to say we have proven and accepted this hypothesis.

6.2 Limitations of the Study

Analysis of the projects key objectives and hypothesis has provided the means to conclude the success of the project. Nonetheless, there were limitation faced within this project.

6.2.1 Time

Due to the projects time constraints various requirements were unable to be implemented, meaning that key findings from the literature review were not able to be tested. One major requirement that was not tested was the ability for natural language processing. As there has been large focus on this aspect in the artificial intelligence community it was felt that by incorporating it into the prototype would not provide anything new to the field and we accept the research that is already out there. To overcome this, the Facebook chatbots instructions included any key words the user may have to type and when processing these inputs they are all converted to lower case to ensure the key word matching would work.

Another key feature that was not able to be implemented was the ability for the Facebook chatbot to deploy the code it creates. As this is a major feature in all of the 3rd party tools, it was easy for participants in the user study get distracted by the fact that the Facebook chatbot was not able to do this and was therefore potentially not as sophisticated. Therefore it was emphasized to users that this feature was not a key focus of the project and that they were to focus on the process of making the chatbot rather than its deployment.

6.2.2 Participants

The demographic of the participants in the user study was very narrow, with all participants being from the University of Bath and being in the age range

of 21 - 22. It can be assumed that people of this age interact with technology highly frequently and find it easier to figure out how to use new tools and technologies. So it is not unreasonable to believe that if the study was to include a wider age range the results could be different. The demographic fitted the requirement of being non-technical but potentially it should have included a number of users who have do not interact with technologies such as computers on a frequent basis. However, considering the results, I would assume there is a significant probability that the trend of tool preference would be the same even when using participants from a wider age range.

6.3 Contributions

This dissertation has provided a number contributions in terms of the product that was produced and the research that was undertaken.

6.3.1 Product contribution

To the best of my knowledge, this is one of the first Facebook chatbot that can be used to develop code which can be used to set-up Facebook chatbots free of charge. The key contribution the system has made are listed as follows:

- The design of system architecture that will take input from users and develop working code based off the users inputs which can then be taken and deployed to set up a chatbot.
- Identification of key human-computer interaction features that can be used to enhance a users experience when interacting with any form of artificial intelligence.
- The proposition of basic features which any baseline chatbot should have based off of the literature review and user studies.
- Provided a platform for users to learn more about the process of chatbot building.
- The development of an interactive Facebook chatbot that is able to produce working code which can be used to create another chatbot based off the users inputs.

6.3.2 Research contributions

The key research contributions made by this dissertation are as follows:

- A review of key human-computer interaction papers were discussed in the literature review and allowed for the collation of critical features of

human preferences when it comes to interacting with artificial intelligence. Therefore this paper can serve as a source of information when looking for important features in bots.

- The design and execution of user studies to evaluate the usability of the proposed system. The study indicated that they preferred the conversational style approach which the Facebook chatbot offered compared to the website style offered by Chatfuel. With the Facebook chatbot having a higher task completion rate this could suggest a new style of leading the users, step by step, to help them achieve their goal instead of leaving them to their own devices and navigating a website.
- The system was designed with the key features discovered in the literature in mind. The results from the user study helped to validate the findings, allowing this dissertation to endorse the findings and encourage other people to incorporate them in their projects.

6.4 Future Work

The system developed as part of this project is in its very early stages and has numerous avenues which have yet to be explored. With more time and resources the following aspects could be research to provide a more complete tool.

Security

During the literature review, a discussion was written on the issue of malicious chatbots or chatterbots, as they are known as, which could be used with potentially malicious intent such as stealing private data. As this dissertation's major focus was the human-computer interaction aspect of the tool the was developed, little resources went into the research about how to make the tool secure. As discussed in the literature review, as the product stands there is a real chance that someone could create a chatbot that could ask users for sensitive data and if the users gives the data they will have no control over how it used. Further analysis would be required to find potential security tools or mechanisms to either prevent users from giving out sensitive information or from them to have some way of retrieving that data if they no longer want the chatbot to have it.

6.4.1 Deployment Tool

As previously mentioned a crucial feature of third party chatbot making tools is the one click deployment buttons, which allow users to connect their chatbot to Facebook at the click of a button. The addition of this feature would complete the work started in this project by creating a Facebook

chatbot that would create and deploy chatbots completely free with easy to follow instructions. This step would appear to require a lot of work and understanding which I did not possess at the start of this project and did not have the time to research as this was not a dependant factor on the dissertations success. So as this functionality already exists I believe with extra time to research a solution can be found.

6.4.2 Offering different platform options

This dissertation mainly focused on Facebook as its platform for creating chatbots on and deploying chatbots to. At the time Facebook was the most popular social media site meaning a vast number of people were familiar with its set up. This meant that less time in the user test was focused on understanding how to use Facebook and more time interacting with the chatbot itself. But chatbots are not just restricted to Facebook and can in fact be integrated in almost all social media sites. Therefore I would propose to look into creating template code, like the one created as part of this project for Facebook, and allow the user at the begin to decide what platform they would like to develop their chatbot for and then inserting their inputs into the associated template code. Further research may be required for a more elegant solution.

6.4.3 User enhancements

As part of the user study users were asked what features they liked and what features they disliked about both the Facebook chatbot and Chatfuel. The following are the users suggestions on how the Facebook chatbot can be improved and therefore suggestions for potential future work.

Customisation options

Providing the option for users to customise their chatbots. Users mentioned that the Facebook chatbot did not allow for any customisation of their chatbots. Due to their prior interactions with Facebook chatbots or just through the interaction with the Facebook chatbot created as part of this project, users were aware there was a potential to add buttons amongst other things to their chatbots for example. The extra customisation options would allow users to create a chatbot which would encourage improved human-computer interaction and therefore potentially increasing the number of uses of the chatbot.

Buttons

Providing more buttons when specific words/phrases need to be typed to move onto the next phase. Users mentioned that the Facebook chatbot

required a number of keywords to be typed and this leaves room for errors, as sometimes people were typing the words/phrases incorrectly. So the addition of buttons decreases the chance of the user deviating by typing incorrect input and therefore allowing the user to complete the task quicker and with more ease.

Instructions

Update the phrasing they Facebook chatbot uses. Some of the users found various instructions confusing due to their phrasing. For example the Facebook chatbot would as the user to type a question or type end to end the process but one user took this as type end at the end of every input they typed. So an update on the phrasing would eliminate this issue or as mentioned previously the addition of buttons. For example it could have a button for typing in a new question and button for ending the process.'

Another issue users faced with the instructions was their length. As discovered in the literature review, talking in long sentences or paragraph can lose users attentions. This issue was considered and formed into a requirement. But as it was not vital to the functioning of the chatbot it was given a low priority and therefore not included in this iteration of the chatbot. Given extra time these lower priority requirements would have been integrated but its now ideas for future work.

6.5 Conclusion

This dissertation has analyzed and extracted key factors found in human-computer interaction literature and has discussed current trends in the use of chatbots along with tools available to create them. The product of this research is a Facebook chatbot which is able to develop code that can be used to create a new chatbot. This Facebook chatbot has implemented they key factors found in the research stage and proven how they can affect a users experience. It has presented significant improvements and new ideas on how to simplify the chatbot building process for non technical users versus existing products.

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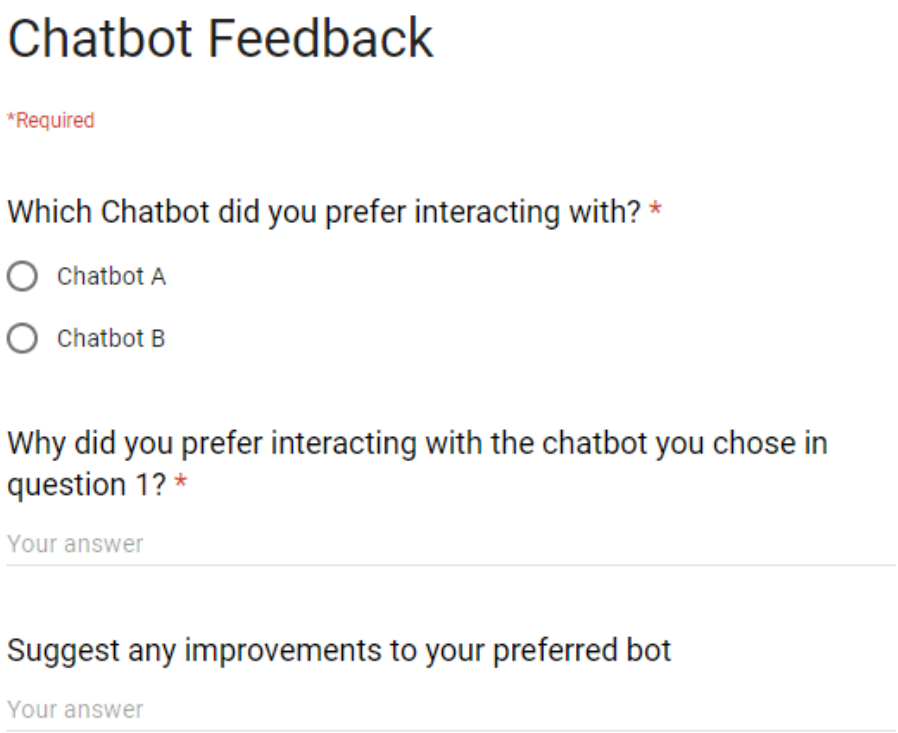
Appendix A

Requirement Research

A.1 Preliminary User Study: Questionnaire



Chatbot Feedback

*Required

Which Chatbot did you prefer interacting with? *

Chatbot A

Chatbot B

Why did you prefer interacting with the chatbot you chose in question 1? *

Your answer

Suggest any improvements to your preferred bot

Your answer

A.2 Preliminary User Study:Responses

Table A.1: Preliminary Questionnaire: Which Chatbot did you prefer interacting with?.

User ID	Response
1	Chatbot B
2	Chatbot B
3	Chatbot B
4	Chatbot B

Table A.2: Preliminary Questionnaire: Why did you prefer interacting with the chatbot you chose in question 1?

User ID	Response
1	As chatbot A did not initialise the conversation I was confused as to what I had to say first so having chatbot A start the conversation removes this confusion and allowed for an easier start to the conversation. Chatbot B also knew my name so this and having it start the conversation gave a much more human like impression. I also preferred Chatbot A's use of emojis as at first I was apprehensive talking to the chatbot and didn't know what to expect but the emoji's gave the conversation a friendly feel and put me at easy.
2	Chatbot Chatbot B was a lot more fun to interact with as it used my name and slightly more relaxed language as where it felt alot more ridged speaking with chatbot A. Chatbot A lacked the personal and human feel that chatbot B has. At the end of the conversation chatbot B gave me the option to select any one of my answers of they were wrong to correct it rather than having to start the process all over again like you had to do in chatbot A. This helped to save a lot of time as spelling mistakes are very easy to make.
3	Chatbot B gave a more personalised experience as it knew what my name was without asking. This also gave me the impression this was a smarter bot which I could therefore trust more. The use of buttons made the process easier as meant that I couldn't type anything wrong. I also liked how chatbot B started the conversation as with chatbot A I was unsure of how to start.
4	Chatbot Chatbot B was more appealing to the eye as it used colourful emojis and buttons to direct you. Chatbot B provided more feedback and opportunity for me to correct my answers than A. Chatbot B used my first name and started the conversation which gave the impression it was more advanced than A so would know more if I asked it.

Table A.3: Preliminary Questionnaire: Suggest any improvements to your preferred bot

User ID	Response
1	Chatbot B made use of buttons but not often enough so maybe add more buttons to make the process quicker. Sometimes there was a delay in the chabot responding and I was unsure if the chatbot was just processing my message or it was broken. So providing something to show that the bot has seen the message and is working on the reply.
2	Instead of sending a file back to the user with their answers in display the answers on the screen to save time. Even though the chatbot starts the conversation it doesn't really introduce itself which I think would help set an even friendlier tone to the conversation.
3	N/A
4	Some how show when the chatbot is typing back to indicate that it is working on the reply.

Appendix B

User Study

B.1 Consent Form

Consent form

Thank you for taking the time to complete a short exercise and interview for my dissertation. The dissertation you will be participating in will be submitted to the Computer Science department at the University of Bath.

This study will involve you reading a short brief and then completing a number of exercises and questionnaires. Overall the exercises and questionnaires should take no longer than 50 minutes. The exercises will be carried out individuals in a time and place convenient for all parties.

If there is any information that you provide during this study that you want to remain confidential and not used with my dissertation please inform me at any point. Your identity will remain anonymous and you instead will be given a participant number which I will use to reference to you within my dissertation.

Part of this user study will also require the use of Facebook. To ensure your privacy, you will be able to complete the task using my Facebook. I will ensure to the best of my abilities you will not be interrupted by any activity on my Facebook during the study. If you would prefer to use your own Facebook please inform me else you are agreeing to use mine and will not disclose any of my personal information you may see to anyone else.

Study Overview:

- Exercise 1 brief
- Exercise 1 (x2 task)
- Exercise 1 questionnaire (x3)
- Exercise 2 brief
- Exercise 2 (x1 task)
- Exercise 2 questionnaire (x1)

To ensure no information is missed I would like to record the activity on the screen which occurs during the test and any things you may say (your face would not be included within this recording). The video footage would not be used within my dissertation but some transcripts of what is seen or what you have said maybe used. Do you agree to being recorded?

Yes No

Do you have any requests for this interview?

Name:

Signed:

Date:

B.2 Study Guide

You will be presented with 2 different methods of creating a chatbot. You will be given specific tasks to complete and will be told which of the 2 methods you should uses to complete each task. You have a limited 15 minutes to complete each task to ensure we can complete the study in a timely manner but these task should not be rushed.

How the tasks work

1. Read the task brief to understand what is to be achieved and ask any questions if necessary
2. You will have a browser with 2 tabs open. Navigate to the correct tab depending on the given task
3. Once in the correct tab the timer will begin
4. Execute the given task until either the given time runs out or you indicate to myself that you have finished
5. You are able to use any of the tools available to you
6. Once you have completed the task it will be tested by you to see if the end product does what you expect it to and myself for the same reason
7. You will then be asked to complete a questionnaire on your experience for each task and then one final overall questionnaire

Task 1
You have 15 minutes to create a chatbot using the Facebook chatbot provided to you. You are to create a chatbot which can be used to survey university students to gain information about their degrees and student satisfaction. The chatbot should ask the following questions:

- What is your name?
- What degree do you study?
- What year of study are you in?
- Rate your university experience from 1 to 5 with 1 being awful and 5 being amazing
- Why did you select this rating?

Your bot must at least have the functionality to ask these questions but should also be able to store these answers and display them back to the user.

Task 2
You have 15 minutes to create a chatbot using the Chatfuel provided to you. You are to create a chatbot which can be used to survey university students to gain information about their degrees and student satisfaction. The chatbot should ask the following questions:

- What is your name?
- What degree do you study?
- What year of study are you in?
- Rate your university experience from 1 to 5 with 1 being awful and 5 being amazing
- Why did you select this rating?

Your bot must at least have the functionality to ask these questions but should also be able to store these answers and display them back to the user.

Task 3
You have 15 minutes to create a chatbot using the method assigned to you. You are to create a chatbot which can be used to create custom pizzas. You can decide what the chatbot asks the users and can use any tools available to you.

B.3 User Test 1 and Test 2 Questionnaires

User Test 1 and Test 2 Questionnaire

*Required

Participant number

Your answer

Please select the task you have completed

- ○ Task 1
- ○ Task 2

Did you manage to complete the task on time? *

- ○ Yes
- ○ No

If you selected no please explain why you believe you did not complete this task on time

Your answer

I found this tool simple to use and follow *

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral

- ○ Agree
- ○ Strongly Agree

Please explain your answer for the previous question *

Your answer

I think I would need further instructions/support to create a Facebook chat bot using this tool *

- ○ Strongly disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly agree

Please explain your answer to the previous question *

Your answer

I believe this tool could be used by people with a little to no technical background *

- ○ Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

Please explain your answer to the previous question

Your answer

Does the Facebook chatbot you created do what you expected it to do? *

- Yes
- No
- Other:

If you selected no please explain why

Your answer

I understood the process of making a chatbot

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Please explain your answer to the previous question

Your answer

B.4 User Test 1: Results

Table B.1: User Test 1: Please select the task you have completed.

User ID	Task
1	Test 1
2	Test 1
3	Test 1
4	Test 1
5	Test 1
6	Test 1
7	Test 1
8	Test 1

Table B.2: User Test 1: Did you manage to complete the task on time?

User ID	Response
1	Yes
2	Yes
3	Yes
4	Yes
5	Yes
6	Yes
7	Yes
8	Yes

Table B.3: User Test 1: I found this tool simple to use and follow? And explanation of answer

User ID	I found this tool simple to use and follow?	Explanation
1	Strongly Agree	There was no room to deviate as the chatbot would lead you onto the next step of the process. The chatbot would tell you exactly what you needed to do to move onto the next step. I was not bombarded with loads of options making it easier for me to decide what to do.
2	Agree	The input required by the user was clear and didnt require any searching to find. It was laid out in nice steps so it was difficult to go wrong.
3	Agree	I was confused initially as to whether I needed to put end after entering a question. So all my questions finish with "end".
4	Agree	I was told what told what to do by the chatbot and didnt have to work out anything for myself.
5	Agree	The instructions were easy to follow and understand but sometimes it was not completely clear what I was required to type to achieve the next step.
6	Agree	instructions were given in a way similar to having to answer questions and didnt require much thinking as each step lead you onto the next
7	Strongly Agree	Told me exactly what I needed to do
8	Strongly Agree	Told me exactly what I needed to do

Table B.4: User Test 1: I think I would need further instructions/support to create a Facebook chat bot using this tool and explanation of answer

User ID	I think I would need further instructions/support to create a Facebook chat bot using this tool	Explanation
1	Strongly disagree	The chatbot gives clear instructions on what to type to move onto the next step.
2	Disagree	I think there were plenty of instructions which I was able to follow but maybe the sentence structures and language needs to be tidied up to make things even clearer.
3	Disagree	The instructions just need to be a little clearer.
4	Disagree	The bot is already self explanatory.
5	Disagree	Format the instructions already given as they have enough details just the wording is not perfect.
6	Strongly disagree	Easy to follow
7	Disagree	There are some parts which need explaining but it offers the option to read an explanation if you need to
8	Disagree	any instructions I needed were already given to me

Table B.5: User Test 1: I believe this tool could be used by people with a little to no technical background and explanation of answer

User ID	I think I would need further instructions/support to create a Facebook chat bot using this tool	Explanation
1	Strongly Agree	This requires no technical knowledge as all you have to do is type in the questions you want your chatbot to ask and then it will do the rest for you
2	Strongly Agree	Easy to follow steps for anyone to follow.
3	Strongly Agree	The user just needs to be able to read and click, so no technical background required at all.
4	Agree	The bot doesnt really use any technical terms and if it does it makes an attempt at explaining them via a link to a page so it means anyone can understand it.
5	Strongly Agree	Easy to follow step by step instructions and just requires you to be able to type. No understanding of the actually bot building process is required
6	Strongly Agree	Anyone could use this as long as they can read and type answers
7	Strongly Agree	Dont have to know anything technical. Just need to read and do what it says
8	Strongly Agree	all you have to do is follow the steps. no technical knowledge is required.

Table B.6: User Test 1: Does the Facebook chatbot you created do what you expected it to do?

User ID	IDoes the Facebook chatbot you created do what you expected it to do? Does the Facebook chatbot you created do what you expected it to do?
1	Yes
2	Yes
3	Yes
4	Yes
5	Yes
6	Yes
7	Yes
8	Yes

Table B.7: User Test 1: I understood the process of making a chatbot and explanation of answer

User ID	I understood the process of making a chatbot	Explanation
1	Neutral	The chatbot offered the option for me to learn more but I didnt click on the button to read more. So I believe this chatbot does offer the option for you to learn if you so wish to
2	Disagree	I saw I had the opportunity to read more information but didnt read it. So I believe there is the option to learn but in the test I did not.
3	Neutral	There is the option to read in more detail but I decided not to.
4	Disagree	I was offered the option to learn more but the explanation given was still slightly technical so I didnt really understand it.
5	Agree	I was directed to a page containing information about the bot building process and was able to read it. So I believe I know a little about how it works but would not be able to build one from scratch myself.
6	Neutral	I was given the option at the end but did not take the chance to read it
7	Disagree	I didnt click on the button for more information. Just need to read and do what it says
8	Disagree	The option was offered but I didnt not read about it

B.5 User Test 2: Results

Table B.8: User Test 2: Please select the task you have completed.

User ID	Task
1	Test 2
2	Test 2
3	Test 2
4	Test 2
5	Test 2
6	Test 2
7	Test 2
8	Test 2

Table B.9: User Test 2: Did you manage to complete the task on time?

User ID	Did you manage to complete the task on time?	Explanation
1	No	There was no clear instructions on how to use various parts of the tool. I used my instincts to create an initial bot but when I tested it it did not so what I expected so the website is not tool. The tool does not lead you in any way onto the next step
2	Yes	N/A
3	No	I had no idea where to start, there was a lot of interactive content on the page with no explanation as to how to use it.
4	No	No instructions and I was confused how to create a chatbox
5	No	I was able to create a conversational bot but I was not able to display the users answers back to them.
6	No	This tool was confusing to use and I could only get the bot to ask all of the questions in one go instead of in a conversational style
7	No	I didnt know what to do. It did not explain where to start.
8	No	could not figure out how to use the tool properly. lots of features but not many explainations

Table B.10: User Test 2: I found this tool simple to use and follow? And explanation of answer

User ID	I found this tool simple to use and follow?	Explanation
1	Strongly Disagree	As I was not able to create a bot that shows that is it not simple to use. There was no flow to follow to help you create a bot. It gives you too many options at once which confused me.
2	Disagree	The tool was confusingly laid out. The option for user input was hidden behind a button. It was not clear that asking multiple questions had to be done in the same 'card'.
3	Strongly Disagree	There were no explicit instructions or guidance on how to use the tool. There was no indication of where to find out how to use it. I could have externally searched the web but I didnt want to. The tool should have just told me what to do.
4	Strongly Disagree	No instructions and I was confused how to create a chatbox
5	Strongly Disagree	No instructions and the thing for making conversations was hidden so required effort to find.
6	Strongly Disagree	I couldnt find instructions and what is on the starting screen is not helpful in showing you what to do
7	Strongly Disagree	I had no idea what to do. It was very confusing and unclear
8	Strongly Disagree	no instructions to follow

Table B.11: User Test 2: I think I would need further instructions/support to create a Facebook chat bot using this tool and explanation of answer

User ID	I think I would need further instructions/support to create a Facebook chat bot using this tool	Explanation
1	Strongly agree	As this site is not intuitive to use in my opinion and has no form of walk through I would require guidance to use it
2	Agree	It was not clear to use, advanced features were hidden.
3	Strongly agree	There were no explicit instructions. There was some content but I was not sure how I was supposed to respond or act on it.
4	Strongly agree	Complicated to use
5	Agree	None of the features had instructions so I had to try it all for myself which took up most of my time.
6	Strongly agree	Too much going on with no explanations on how to use everything
7	Strongly agree	The support button lead me to a closed Facebook group which is not publicly available to read, you have to be a member, or to sending an email. No way to get instructions fast
8	Strongly agree	lots of features in the tool making it complicated to use

Table B.12: User Test 2: I believe this tool could be used by people with a little to no technical background and explanation of answer

User ID	I think I would need further instructions/support to create a Facebook chat bot using this tool	Explanation
1	Disagree	I do not believe using this tool requires technical knowledge but as there are little to no instructions I do not believe technical or non technical people could use it without help
2	Disagree	The tool seemed aimed at people with a technical background.
3	Neutral	I don't think that the problem with this tool is that it is "too technical". It is just vague and not intuitive.
4	Strongly Disagree	Doesn't explain enough what chatbox is
5	Neutral	I do not believe technical knowledge is required to use this tool but due to its lay out and lack of instructions I do believe alot of people with different backgrounds would struggle to use it.
6	Disagree	some features had technical names which I was not able to understand and so couldnt figure out what it did.
7	Strongly Disagree	I think this would be confusing to anyone
8	Strongly Disagree	I couldnt figure out how to use it

Table B.13: User Test 2: Does the Facebook chatbot you created do what you expected it to do? And Explanation

User ID	Does the Facebook chatbot you created do what you expected it to do?	Explanation
1	No	I was not able to complete the task and the bot I did create did not do what I expected as it would send all of the answers at once and not one at a time after the user has previously answered. I also could not find an option to show the users their answers once they had completed the questions
2	I could not store the answers to my questions	N/A
3	Didn't finish on time	N/A
4	Ran out of time	N/A
5	It does carry out a conversation but cannot display answers	N/A
6	No	It asked all the questions at once, not in a conversational style N/A
7	Didnt finish in time	N/A
8	didnt finish	N/A

Table B.14: User Test 2: I understood the process of making a chatbot and explanation of answer

User ID	I understood the process of making a chatbot	Explanation
1	Strongly disagree	As I could not work out how to use this tool I do not feel I understand the chatbot making process any better. This tool also did not offer me a chance to learn anything more about the chatbot making process
2	Disagree	There was no option to learn any more.
3	Strongly disagree	No idea how it worked at all, no explanation.
4	Strongly disagree	I found it hard to use
5	Strongly disagree	Nothing was explained and I only managed to create something by brute force trying different features until something worked
6	Strongly disagree	I have no idea how to build a chatbot from this website
7	Strongly disagree	I had no idea how to make one
8	Strongly disagree	there was no way to learn

B.6 Comparison Questionnaire

Comparison Questionnaire

*Required

Participant number

Your answer

Out of the 2 tools you used which tool did you prefer? *

- ○ The Facebook Chabot
- ○ The 3rd party tool 'Chatfuel'

Please explain why this was your preferred tool

Your answer

Which of the 2 tools would you use if you were going to create a Facebook chatbot in the future? *

- ○ The Facebook Chatbot
- ○ The 3rd party tool 'Chatfuel'
- ○ Neither

Please explain your answer to the previous question

Your answer

Which of the 2 tools produced a chatbot closest to your expectation? *

- ◯ The Facebook Chatbot
- ◯ The third party tool 'Chatfuel'

Please explain why you think your chosen tool produced a chatbot closet to your expectation *

Your answer

Which of the 2 tools gave the most user friendly experience?

- ◯ The Facebook Chatbot
- ◯ The third party tool 'Chatfuel'

Please explain your answer to the previous question *

Your answer

B.7 Comparison Questionnaire: Results

Table B.15: Comparison Questionnaire: Out of the 2 tools you used which tool did you prefer? And Explanation

User ID	Out of the 2 tools you used which tool did you prefer?	Explanation
1	The Facebook Chabot	It was simple and clear to use. I was able to create a chatbot at the end and it did what I expected it to do. It was more user friendly as it broke the task up by asking you simple questions which would help you move onto the next step instead of overwhelming you with loads of options.
2	The Facebook Chabot	It was simpler to use than chatfuel.
3	The Facebook Chabot	It was quick to understand, use and obtain working results.
4	The Facebook Chabot	It was simpler to follow as instructions were given to you. Chatfuel was difficult to navigate and use.
5	The Facebook Chabot	Simpler and clearer to use.
6	The Facebook Chabot	Simpler to use as it told me what to do
7	The Facebook Chabot	Told me what to do in simple terms
8	The Facebook Chabot	hard to go wrong because of simple instructions

Table B.16: Comparison Questionnaire: Which of the 2 tools would you use if you were going to create a Facebook chatbot in the future? And Explanation

User ID	Out of the 2 tools you used which tool did you prefer?	Explanation
1	The Facebook Chabot	I feel I would be more likely to be able to create a chatbot using this tool and it would do what I would expect it to. It felt more like someone was helping me through the process as it was in a conversation format instead of being left alone to click loads of button like in Chatfuel.
2	The Facebook Chabot	it was faster to use than chatfuel
3	The Facebook Chabot	Did not require a lot of effort and provided results quickly
4	Neither	I felt like bot products had flaws. Chatfuel was complicated to use and the Facebook chatbot was restrictive. It didnt allow you to have many customisations. So I would look for something which allowed for customisation and simple instructions.
5	The Facebook Chabot	Quick and easy to use if I wanted to create a simplistic chatbot
6	The Facebook Chabot	Quick and easy to use
7	The Facebook Chabot	easier to use
8	The Facebook Chabot	easy to use

Table B.17: Comparison Questionnaire: Which of the 2 tools produced a chatbot closest to your expectation? And Explanation

User ID	Out of the 2 tools you used which tool did you prefer?	Explanation
1	The Facebook Chabot	It left little room for you to go wrong and would tell you exactly what you needed to do.
2	The Facebook Chabot	i was not able to save the information using chatfuel
3	The Facebook Chabot	It looked as I expected a chat bot to look whereas Chatfuel didn't match with my expectation.
4	The Facebook Chabot	Easy to follow instructions allowed me to easily create the bot required.
5	The Facebook Chabot	Chatfuel features were too difficult to use and figure out. The facebook chatbot was simpler and I could figure out how to use it properly.
6	The Facebook Chabot	It told me exactly what to do to make the type of chatbot I was required to make
7	The Facebook Chabot	didnt have loads of buttons/features so was easy to figure out what to do
8	The Facebook Chabot	it had instructions I could follow

Table B.18: Comparison Questionnaire: Which of the 2 tools gave the most user friendly experience? And Explanation

User ID	Out of the 2 tools you used which tool did you prefer?	Explanation
1	The Facebook Chabot	It was far easier to use and required less of me which made the process a lot more relax. The conversation format made it a bit more fun and personal especially as it used my name and emojis which made me feel like a person was taking me through the process.
2	The Facebook Chabot	it was simpler than using the confusing chatfuel website
3	The Facebook Chabot	Intuitive, clear instructions.
4	The Facebook Chabot	Simple to use and familiar lay out of a chat reduced the complications that chatfuel had of navigate lots of different web pages
5	The Facebook Chabot	It gives instructions without having to look for them and felt like a person was helping me as it was in a conversation style
6	The Facebook Chabot	Easier to use
7	The Facebook Chabot	It was easy to figure out how to use it
8	The Facebook Chabot	it was not overcomplicated meaning it was usable and I could achieve something with it

B.8 User Test 3: Questionnaire

User Test 3 Questionnaire

*Required

Participant number

Your answer

What tool did you use?

- ◯ The Facebook Chatbot
- ◯ Chatfuel

Does the Facebook chatbot you created do what you expected it to do? *

- ◯ Yes
- ◯ No

If you selected no please explain why

Your answer

How did using this tool make you feel and please explain your answer (e.g. happy, sad, confused) *

Your answer

Would you use this tool again to create a chatbot? *

- ◯ Yes
- ◯ No

Please explain your answer to the previous question *

Your answer

Please identify some of the key features that you liked about this tool *

Your answer

Please identify some of the key features that you disliked about the this tool *

Your answer

Can you suggest any improvements to this tool? *

Your answer

B.9 User Test 3: Results

Table B.19: User Test 3: What tool did you use?

User ID	Tool
1	The Facebook Chatbot
2	Chatfuel
3	The Facebook Chatbot
4	Chatfuel
5	The Facebook Chatbot
6	Chatfuel
7	The Facebook Chatbot
8	Chatfuel

Table B.20: User Test 3: Does the Facebook chatbot you created do what you expected it to do? And Explanation

User ID	Does the Facebook chatbot you created do what you expected it to do?	Explanation
1	Yes	I was not able to complete the task and the bot I did create did not do what I expected as it would send all of the answers at once and not one at a time after the user has previously answered. I also could not find an option to show the users their answers once they had completed the questions
2	Yes	N/A
3	Yes	N/A
4	No	I was not able to complete the task on time
5	Yes	N/A
6	No	I could not work out how to get the bot to have a conversation. It would just ask all of the questions in one go
7	Yes	N/A
8	No	Was not able to figure out how to get the bot to ask questions and wait for the user to reply

Table B.21: User Test 3: How did using this tool make you feel and please explain your answer (e.g. happy, sad, confused)

User ID	How did using this tool make you feel and please explain your answer (e.g. happy, sad, confused)
1	It made me feel relaxed and comfortable as I was not struggling to understand what to do next. It also made me feel intrigued as I was curious at how it was able to know my name and how it created me a chatbot from our conversation
2	This tool made me feel content as it did create my expected chatbot but also confused as the layer of the website was not easy to follow making the process more difficult than it needed to be.
3	Satisfied
4	It made me feel confused and annoyed as I could not figure out how to create my own chatbot correctly. Each one I attempted to make did not do what I expected.
5	Happy as it had little surprises like knowing my name and used language I could understand.
6	Angry and frustrated because I couldnt work out how to use it and complete the task
7	excited because it was easy to use and allowed me to achieve something I didnt think I would be able to make on my own
8	sad because I couldnt complete the task and frustrated because I couldnt figure out how to use it

Table B.22: User Test 3: Would you use this tool again to create a chatbot? And Explanation

User ID	Would you use this tool again to create a chatbot?	Explanation
1	Yes	Its simple to use and produces a chatbot that does that I expect it to do with no fuss
2	No	I was able to work out the basics of the website but learning how to use the other features of the site seemed too difficult and time consuming.
3	Yes	Easy to use
4	No	Too difficult to use.
5	Yes	It would let me easily create and chatbot which would work as I expect
6	No	to complicated to use
7	Yes	easy and simple to use
8	No	too complicated to use

Table B.23: User Test 3: Please identify some of the key features that you liked about this tool

User ID	Please identify some of the key features that you liked about this tool
1	The way it leads you onto the next steps. It doesnt leave you wondering what you need to type as it tells you. As it starts the conversation with you theres no confusion on how to start the process
2	I liked that you were able to test your chatbot at any stage of the process and didnt have to have a complete bot to test.
3	Concise introduction to the tool
4	I could not work out any of the features so cannot identify any I like
5	Simple instructions. The options to learn more/get more information on things may have confused me. The fun human like language which made it feel less like a bot
6	Not much typing is required. Everything can be added just by clicking
7	The way in which it seems like you are talking to a human. It uses like your name and not tech terms so seemed less like a bot. The simple instructions on completing the process
8	none

Table B.24: User Test 3: Please identify some of the key features that you disliked about the this tool

User ID	Please identify some of the key features that you disliked about the this tool
1	Using this chatbot did require a lot of typing which I feel could have been replaced with buttons perhaps.
2	Key features like setting up a conversation seemed to be hidden and I struggled to find instructions on how to use any of the features making the process difficult.
3	The wording of the instructions was confusing on the first read.
4	The lack of instructions on how to use the website and how different features are spread over a number of different pages making it difficult to find things.
5	Sometimes it was not clear straight away what was needed to be typed to move onto the next step
6	Lack of support on how to use the tool
7	having to type specific words. If I typed it wrong I would have to do it again until I got it right
8	lack of clear instructions of walkthrough on how to even create a simple bot

Table B.25: User Test 3: Can you suggest any improvements to this tool?

User ID	Can you suggest any improvements to this tool?
1	To have more customisation options for my chatbot such as the addition of buttons. Sometimes there was quite a lot of writing in the conversation bubbles from the chatbot so to limit that down.
2	Instructions on how to use it.
3	Slight changes to instruction wording
4	Have an instructions page or a template bot to follow
5	Use more buttons instead of getting the user to write specific things to remove confusion
6	Instructions on how to start
7	use more buttons if specific words much be used
8	add instructions or a tutorial

B.10 User Test Timings

Table B.26: User Test Timings (minutes)

User ID	Test 1	Test 2	Test 3
1	6	DNF	5.01
2	4.25	14.01	10.11
3	5.01	DNF	4.50
4	8.50	DNF	DNF
5	4.15	DNF	3.59
6	5.55	DNF	DNF
7	6.10	DNF	5.01
8	6.01	DNF	DNF

**DNF - Did not finish*

Appendix C

Requirement Evaluation

Table C.1: Requirement Evaluation

Requirement ID	Priority	Satisfied	Supporting Evidence
FR1	1	Yes	Working chatbot created as part of the user study
FR2	2	Yes	See section 5.5 for discussion
FR3	4	Yes	See section 5.5 for discussion
FR4	4	Yes	See section 5.5 for discussion
FR5	3	No	Due to the nature of the chatbot that was created it was deemed unnecessary to implement and vasts amount of research has been invested in this area so adding it to my chatbot would produce no new findings
FR6	4	No	Would have required a substantial amount of resources to implement a low priority requirement
FR7	3	Yes	see section 5.5 for discussion
FR8	3	Yes	Read recipients and typing animations were implemented to show progression
FR9	1	Yes	Working chatbot created as part of the user study
FR10	1	Yes	Working chatbot created as part of the user study

Table C.2: Requirement Evaluation: Continued

Requirement ID	Priority	Satisfied	Supporting Evidence
FR11	1	Yes	Working chatbot created as part of the user study
FR12	1	Yes	Before the conversation before the user and the chatbot begins the user must click a button to start which informs them that is they click this button they are giving permission for the chatbot to access their profiles public information
FR13	1	Yes	Working chatbot created as part of the user study
FR14	2	Yes	Working chatbot created as part of the user study
FR15	1	No	see section 6.4 for discussion
FR16	5	Yes	see section 5.5 for discussion
UR17	1	Yes	Users were asked to verbally confirm before user study began
UR18	1	Yes	Users were asked to verbally confirm before user study began
UR19	1	Yes	Users were asked to verbally confirm before user study began
UR20	1	Yes	see section 5.5 got discussion