

MASTER

Sharing and Promotion Gratitude with a Chatbot

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Sharing and Promotion Gratitude with a Chatbot

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“Gratitude is not only the greatest of virtues, but the parent of all the others.”

- *Marcus Tullius Cicero*

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Abstract

Depression and anxiety are mental disorders that are considered common diseases since 7.2% of the worldwide population (around 538 million people) suffers from them (World Health Organization, 2017; World Health Organization, 2020). One way of preventing common mental disorders is through positive psychology. This discipline focuses on strengthening the virtues of people with the objective of promoting their own satisfaction and increasing their authentic happiness. Satisfaction with life and happiness are linked with the subjective well-being of people (Compton & Hoffman, 2019). Gratitude is an emotion that boosts the perceived happiness and wellbeing in people (Wood, Joseph & Maltby, 2009). A usual misconception about gratitude is that it is perceived only as an individual activity when it can also be triggered by social interaction with other people. An experiment was conducted in which a 5-minute interaction during three consecutive days with a chatbot (N = 133) that promotes and shares gratitude, leads to the increment of positive feelings and gratitude levels in people while their negative feelings decrease. Moreover, during the conversation with the gratitude chatbot participants showed self-disclosure by sharing personal experiences that include the ending of a relationship, expressing the arrival of a new baby, describing insightful moments with their friends or sharing that a family member just recovered from a severe illness.

Key words: Positive psychology, chatbots, mental health, gratitude, well-being, positive emotions, prosocial behavior.

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1 Introduction

In 2017 it was estimated that 538 million people around the globe suffer from depression or anxiety, which represent approximately 7.2% of the worldwide population (World Health Organization, 2017; World Health Organization, 2020). Unfortunately, the number of people who are experiencing these diseases is constantly increasing. Even though there are already several therapies and medicines that assist in the treatment of common mental disorders, a considerable amount of the common mental disorders can be prevented. Regrettably, the effort to avoid the development of those illnesses is still insufficient.

One way of preventing common mental disorders is through positive psychology. This discipline focuses on strengthening the virtues of people with the objective of promoting their own satisfaction and increasing their authentic happiness. Satisfaction with life and happiness are emotions that are linked with the subjective well-being of people (Compton & Hoffman, 2019). Consequently, the subjective well-being of a person can be increased when this particular individual is motivated to execute activities that improve their perceived happiness helping them to maintain a healthy state of mind (Wood, Froh & Geraghty, 2010).

Gratitude is an emotion that boosts the perceived happiness and wellbeing in people (Wood, Joseph & Maltby, 2009). This emotion can be triggered in several ways. The most common one is having a gratitude diary. This implies that a person is asked to reflect on their activities performed during the day and write down the most significant activity or the one that had provided them the greatest satisfaction (O'Leary & Dockray, 2015). People can also experience gratitude when they feel valued and appreciated by other people (Gordon, Arnette & Smith, 2011). Additionally, sharing gratitude among people increases reciprocity and kindness. (Algoe, Haidt, & Gable, 2008; Nowak & Roch, 2007).

A usual misconception about gratitude is that it is perceived only as an individual activity when it can also be triggered by social interaction with other people. Humans, as social beings, need constant contact with other individuals. Over the years the interaction among people has been transforming from a physical environment to either an online environment or a combination of both. The online environment includes the interaction and connection of people through messaging services and social media. Due to the popularization of messaging services, people have become used to engaging in asynchronous conversations through text messages (Brandtzaeg & Følstad, 2017).

Thereby, the increased use of technology, and particularly, text messages, has provoked the popularization of chatbots. These software applications have recently been applied in several domains, of which the sales or customer service domains are the most popular ones. However, chatbots have also been used in the mental health area playing the role of personal companions because they are always available to listen to a person and help them to find comfort and feel better in order to increase their well-being (Fitzpatrick, Darcy & Vierhile, 2017).

In this way, chatbots can be programmed to discuss a specific topic with humans, since above studies have shown that gratitude can have a positive impact on the life of people. This study seeks to combine the use of chatbots and the practice of gratitude emotions. Consequently, a chatbot whose objective is promoting and sharing gratitude with a person is implemented. The promotion of gratitude consists of a chatbot asking a person to think about situations of their life or activities performed during the day which the person can feel thankful for. In addition, sharing gratitude consists of the chatbot telling a human that it feels appreciated and it shares with the person grateful thoughts.

This study consists of both qualitative and quantitative methods. Therefore, this study addresses the following research questions:

Qualitative Research Question:

“What type of information or experiences are people comfortable sharing with a chatbot that could be related to their feelings of gratitude?”

Quantitative Research Question:

“What is the effect on subjective well-being after a 5-minute interaction during three consecutive days with a chatbot that promotes and shares gratitude with a person?”

The qualitative research question has the intention of determining if a person feels comfortable having a conversation with a chatbot, particularly noticing if they share personal experiences with the bot. Sharing personal experiences involves self-disclosure where the voluntary expression of opinions, thoughts, beliefs, experiences, preferences, values, and personal history is presented (Ravichander & Black, 2018). This qualitative objective does not have a hypothesis linked to the exploratory qualitative research question.

The purpose of the quantitative analysis is making an evaluation to determine if there is an increment in the gratitude levels and positive feelings of a person. The hypothesis related to the quantitative research questions is the following:

Quantitative Hypothesis:

A 5-minute interaction during three consecutive days with a chatbot that promotes and shares gratitude with a person will increase the gratitude levels of the person.

The structure of this report is as follows: Section 2 describes the literature behind the research questions and introduces the hypothesis. Section 3 illustrates the methodology followed to perform an experiment to test the hypothesis. Section 4 provides the results of the experiment which are discussed in Section 5. Finally, Section 6 contains the conclusions of the report.

2 Literature Review

This section provides the definition of positive psychology, gratitude and chatbots. Likewise, the benefits of using positive psychology and gratitude in people's life are also described. Thereafter, the uses and advantages of chatbots are mentioned alongside the hypothesis for this study.

2.1 Positive Psychology and well-being

Positive psychology "is the scientific study of ordinary human strengths and virtues. Positive psychology revisits "the average person" with an interest in finding out what works, what's right, and what's improving" (Sheldon & King, 2001, p.216). Positive psychology emerges from the necessity of strengthening humans' potentials, capacities, motives and nurturing their intellect (Compton & Hoffman, 2019; Sheldon & King, 2001). This implies the revision of personal behaviours with the intention to discover if some of those are right or wrong and, more importantly, understand which behaviours need to be improved (Sheldon & King, 2001). The ultimate objective of positive psychology is to achieve the complete flourishing of a person in a holistic perspective which can include a biological, personal, relational, institutional, and cultural level (Compton & Hoffman, 2019). Positive Psychology emphasizes emotions, particularly the ones that are considered positive such as happiness, love, joy, relaxation, intimacy, contentment, and satisfaction with life (Compton & Hoffman, 2019).

Satisfaction with life is what many people consider as having a good life. This implies using peoples' personal values and virtues to create authentic happiness and abundant gratification in a way that at the end, individuals can obtain the feeling of having a well-lived, well-worth and fulfilling life (Compton & Hoffman, 2019). Happiness and satisfaction with life are intertwined characteristics that help to measure the level of subjective well-being in a person. Subjective well-being is defined as a set of enjoyable emotions that comprises low levels of negative affect, high levels of positive affect and a high life satisfaction (Diener, Lucas, & Oishi, 2002; Wood et al., 2010). The positive emotions and experiences incorporated in subjective well-being represent a main part of positive psychology because this is what creates the feeling of having a well-rewarded and fulfilled life (Diener et al., 2002).

According to several studies, positive psychology helps to increase subjective well-being in people. Sin and Lyubomirsky (2009) have found that positive psychology interventions in people with mental health issues significantly increase their wellbeing and decrease their depressive

symptoms. Those interventions included intentional activities or treatment methods whose objective is to generate positive cognitions, behaviors, or feelings (Sin & Lyubomirskly, 2009).

Additionally, Waters (2011) expresses that positive psychology encourages a better academic performance in students and improves their wellbeing. Having a positive approach in schools helps the students to strengthen their character, develop resilience, and nurture positive emotions (Waters, 2011). Likewise, elderly people can also benefit from positive psychology interventions. Proyer, Gander, Wellenzohn and Ruch (2014) have discovered that implementing positive psychology in elderly people helps them to improve their happiness and well-being, as well as to reduce their depressive symptoms.

Implementing positive psychology techniques has an impact on the happiness and well-being of people. As previously mentioned, positive psychology interventions can be performed in diverse groups of people that can include, but are not being limited to, clinical psychology patients, students, and elderly. Thereby, one of the advantages of positive psychology is its capability of producing a favorable impact on people irrespective of their profile and/or background. Hence, the main objective of using a positive psychology approach, techniques and interventions is producing positive emotions in people and improving their wellbeing.

2.2 Gratitude

Gratitude is a rich concept that encompasses several definitions, usages and interpretations that have been promoted through the years. Additionally, gratitude can also be found either as an individual or social construct with various positive effects for the people. Therefore, in this section the definition of gratitude is presented alongside its benefits and relationship with other virtues and emotions of the human being.

2.2.1 Definition of Gratitude

In accordance with its etymological construction, the word Gratitude came from the Latin *gratia*, which means favor, and *gratus* whose meaning is pleasing (Emmons, 2004). Based on this Latin root the word gratitude has positive connotations that are related to a pleasant feeling and a thankful sensation of giving and receiving gifts coming from kindness or generosity (Emmons, 2004; Watkins, 2013). Moreover, gratitude can be experienced from different perspectives since it can be categorized as an emotion, affective trait, or mood (Emmons & Mishra, 2011; Watkins, 2013).

Gratitude is considered an emotion because it possesses positive affect and a similar duration to other positive emotions to which it covaries (Watkins, 2013). However, an exception in the duration of gratitude compared to other emotions, is that gratitude can last longer if the event that it is related to this emotion is considered significantly more important or with a bigger impact in the life of the person that is experiencing gratitude (Watkins, 2013). Watkins (2013) highlights that every emotion predisposes people to act or behave in particular ways. For example, if a person is afraid, it is more likely that they feel the necessity of running. Hence, it is important to emphasize which type of actions are triggered by gratitude. In this case, gratitude tends to promote prosocial behavior by fostering relationships that rely on social exchange (Jia, Lee, & Tong, 2015; Mathews & Shook, 2013). Due to those characteristics, gratitude is not only considered as an emotion, but more particularly is recognized as a moral emotion. The latter is due to gratitude coming with a prosocial behavior which makes the beneficiary tend to help and cooperate either with his benefactor or with other people (Jia et al., 2015).

In order to consider gratitude as an affective trait, people need to have a predisposition to recognize and respond with gratitude easily and often (McCullough, Emmons, & Tsang, 2002; Watkins, 2013). According to Watkins (2013), gratitude as an affective trait is formed by four facets. The first one is **intensity** which implies experiencing gratitude intensively posterior of receiving a benefit. This intensity needs to be comparatively higher regarding other individuals. The second facet corresponds to the **frequency**. It implies how often a person is able to experience gratitude. **Span** is the third facet. It involves the number of life circumstances to which a person can feel grateful in a determined time. The last facet is **density**, which makes a reference of the number of people or sources a person can consider as benefactors or providers for their gratitude. Hence, to consider gratitude as an affective trait it is needed to experience gratitude intensively and often as well as having a variety of benefactors that provide multiple circumstances to feel grateful in a determined period of time.

Mood and emotion are often used interchangeably; however, they refer to different transient states. Emotions have a shorter duration compared with moods. Thus, gratitude as a mood is normally more enduring due to its larger duration. Another characteristic of the gratitude mood is that it can be running in the background of awareness of people. This implies that if a person is experiencing a gratitude mood it can promote to have more grateful emotions (Watkins, 2013).

In addition to the categorization that gratitude can have, the important part to consider are the benefits that gratitude possesses. As previously mentioned, once a person is experiencing gratitude, they are more willing to maintain and promote that grateful state. Therefore, it is

common that a person remains in a grateful state that produces certain pleasure and happiness, which in a way, is linked with the wellbeing and satisfaction of life that are connected with the positive psychology. For the purpose of this study, gratitude will be considered as an emotion due to its characteristic of having positive affect which will help the measurement of wellbeing in people.

2.2.2 Gratitude and Well-being

Research has shown that gratitude can lead to increased well-being in people (Alkozei, Smith, & Killgore, 2018; Emmons & Mishra, 2011; Killen & Macaskill, 2015). The reasons for the increase in well-being will be explained as follows. Killen and Macaskill (2015) mention that a direct and indirect relationship in gratitude can influence well-being. On one hand, gratitude can be perceived as a direct causal agent of wellbeing. On the other hand, gratitude indirectly diminishes negative states and emotions which in turn induces the incrementation of well-being. Emmons and Mishra (2011) also agree with the posture of gratitude diminishing negative affect that leads to an incrementation of positive affect and higher well-being. Although, Alkozei et al. (2018) do not make an emphasis on the negative feelings, they mention that gratitude allows the appreciation of the positive aspects in life, and this is what makes the subjective well-being rise.

Gratitude techniques have been implemented in healthy individuals as well as in people with preexisting diseases. In both cases there has been found an increment in the well-being of people (Alkozei et al., 2018; Emmons & Mishra, 2011). Therefore, gratitude represents a worthy emotion to have and practice in order to feel better. A benefit of being grateful is that the person avoids taking things for granted which make them appreciate and enjoy what they have in the present moment (Emmons & Mishra, 2011). In this way, a grateful person is embracing their own potential by being aware of their surroundings. Alongside this, gratitude is related to positive psychology since the objective of the latter also seeks to increase the potential of the human being through their own introspection and improvement of their own self.

2.2.3 Promoting and Sharing Gratitude

Gratitude has been mistakenly considered as an activity that can be only experienced on an individual level where the person is merely aware and thankful for the situations that occur to himself (Gordon et al., 2011). However, gratitude can also be triggered by interpersonal interactions and relationships due to its potential to create prosocial behaviors (Gordon et al., 2011). This implies that gratitude can be experienced from two different perspectives. On one

hand, a person can develop their own gratitude, while on the other hand, the person needs the interaction with other people to experience gratitude. In other words, gratitude can be stimulated either by the promotion of a person's own gratitude or sharing this gratitude with someone else.

The promotion of gratitude implies that a person can encourage their own gratitude by making a reflection about certain situations in their life that they can feel thankful for (O'Leary & Dockray, 2015). The promotion of gratitude seeks the nurturance and reward through a motivational orientation toward accomplishment (Mathews & Shook, 2013). Gratitude's promotion can be developed through gratitude interventions. These interventions have been a crucial element in the success of positive psychology because they involve reflection about situations in which a person can feel grateful for in a determined period of time (O'Leary & Dockray, 2015; Wood et al., 2010).

According to Wood et al., (2010) there are three types of gratitude interventions. The first one involves making a list of things for which a person can be grateful. This list needs to be done on a regular basis; hence many people choose to have a gratitude diary to keep track of their grateful ideas every day. Southwell and Gould (2017) have found that keeping a gratitude diary increases the subjective well-being in people as well as diminishing their scores in depression, anxiety, and stress. The second gratitude intervention is the grateful contemplation which requires thinking about a grateful situation with a global perspective. This means the contemplation and remembering moments lived over the last year, for example, recalling and writing down situations experienced during the previous summer. Finally, the third intervention is the behavioral expressions of gratitude which involves thanking a benefactor through a letter for the gift they have provided. A benefactor is any person that has provided help or support in the past towards a particular situation in which a gift or contribution might have been offered. The indicated present could have been either physically or symbolically. The first one refers to monetary or financial support while the latter is related to moral support which might involve, but is not limited to, provide guidance, information, acceptance, affection, time, patience, or advice.

Moreover, gratitude can also be experienced through the interaction with other people. Implying that a person needs to share grateful thoughts to another one, so the latter can feel appreciated and be able to experience this emotion as well. The main advantage of sharing gratitude is increasing the well-being in people at the same time that depression symptoms can also be alleviated (Chang, Li, Teng, Berki, & Chen, 2013; Gordon et al., 2011). Sharing gratitude commonly occurs between couples or close friends (Algoe, Gable, & Maisel, 2010; Chang et al., 2013; Gordon et al., 2011). Chang et al., (2013) have found that it is possible to reduce depression

symptoms of a spouse when the partner shows appreciation and gratitude for the activities and company that the spouse is providing. This is related with the findings of Gordon et al., (2011) where it is expressed that the acknowledgement and appreciation for a partner represent showing gratitude for the existence of the partner. In this way, the partner feels supported, empowered, understood, and appreciated which leads to an increase in their well-being (Gordon et al., 2011).

Additionally, a person that experiences gratitude through the intentional generosity from another individual is more willing to repay the actions either to the benefactor or to a third person. This produces greater satisfaction and increases the well-being of the person (Algoe et al., 2008; Algoe et al., 2010). Even though gratitude emotions can be originated and experienced in an individual approach, those emotions produce more benefits when they are reciprocally shared between two people that live together creating a healthier environment (Chang et al., 2013).

2.3 Chatbots

2.3.1 Definition, Origins and Uses of Chatbots

The word chatbot is derived from 'chat robot' which represent any software application or machine agent with the ability of engaging in a conversation or interaction with a human through text or voice (Abd-alrazaq, Alajlani, Alalwan, Bewick, Gardner, & Househ, 2019; Brandtzaeg & Følstad, 2018; Dale, 2016). The main function of a chatbot is allowing humans to ask them questions, give commands or interact with them in a conversation using natural language with the purpose of obtaining a specific content or service from the chatbot (Brandtzaeg & Følstad, 2018).

The origins of the chatbots date back to the 1960s with the creation of Eliza, the first recognized chatbot; followed by Parry and Alice (Shum, He & Li, 2018). Those three chatbots were acknowledged as early conversation systems which used a text template-based response that matched simple patterns to simulate a conversation mimicking human behavior within a controlled environment (Dale, 2016; Shum et al., 2018). Another remark on the history of chatbots is Clippy, the Microsoft Office Assistant available during 1997 to 2003. Even though Clippy did not converse in natural language and some people do not consider it as a chatbot, this assistant set the basics of the UI paradigm used in current chatbots which is particularly similar as the one imposed by Clippy (Dale, 2016).

Throughout the years, chatbots have been evolving into becoming today's intelligent voice-driven digital personal assistants, being Apple's Siri, Microsoft Cortana, Google Assistant and Amazon's Alexa the leaders in cutting-edge technology (Dale, 2016; Shum et al., 2018). However, the

biggest challenge for chatbots has always been the constant improvement of the ability of conversing with humans using natural language (Shum et al., 2018). As mentioned, chatbots applications, particularly text-based, have been among us for quite some time. This has enabled the development of thousands of chatbots with target specific functionalities used in diverse messaging platforms (Dale, 2016).

Nowadays chatbots are used in diverse task completion systems such as sales or customer service. For example, chatbots can reserve airline tickets, give specific information about a product or service, make purchases, or provide general assistance about an online order (Shum et al., 2018). Unfortunately, not all the chatbot implementations turn out to be as successful as planned. This is the case of Anna, the customer service chatbot implemented by Ikea between 2005 and 2016. Anna aimed to be available to customers all the time to answer their questions and guide them around the Ikea website. However, according to Brandtzaeg and Følstad (2018) Anna's flaw was being 'too human'. In some cases, when the chatbot tries too hard to be natural it deviates from its purpose which is to provide faster answers. In the particular case of Anna, this chatbot had problems balancing the human and robot characteristics provoking that a huge number of customers consider her too human and decided to ask her non-related Ikea questions that often were foolish, ridiculous and/or sex related (Brandtzaeg & Følstad, 2018).

Due to the increasing usage of the internet and social networks and the fundamentally social nature of human beings, it is unsurprising that social chatbots appeared. Social chatbots were developed to engage with humans to communicate more noticeably with affect and social belonging (Shum et al., 2018). Ideally, social chatbots should be able to recognize and track emotions in a conversation (Shum et al., 2018).

2.3.2 Chatbots and Mental Health

Social chatbots have also been used in the mental health area to provide cognitive behavioral therapy, give training focused on people with autism, diminish depression and anxiety symptoms, improve social skills, and help in the treatment of people with dementia or post-traumatic stress disorders (Abd-alrazaq et al., 2019). Particularly, social chatbots can be more useful for this scope since they have the ability of establishing an emotional connection with users serving as virtual companions satisfying the social needs of the user (Shum et al., 2018). In this case, the main purpose of the chatbot is being available at any time to provide attention and companionship to the user rather than being able to provide all the answers to the questions that the user might have (Shum et al., 2018).

People have shown a preference for chatbots not only because they are available at any time but also because chatbots do not judge the person which make them more willing to share their thoughts, at the same time that the stigmatization of seeking mental health is reduced (Abd-alrazaq et al., 2019). Moreover, chatbots are preferred by people due to their productivity. On one hand, chatbots provide efficient assistance and information (Brandtzaeg & Følstad, 2017). On the other hand, chatbots provide the comfort of having short-typed interactions that humans are used to having alongside with the multiple asynchronous conversations that people normally maintain at the same time (Brandtzaeg & Følstad, 2017).

Social chatbots have demonstrated to be a versatile tool that is able to adapt to the user's needs through empathy (Shum et al., 2018). Some people prefer to use chatbots because they are looking for different social experiences than friends or family can provide (Brandtzaeg & Følstad, 2018). Due to the multiple benefits that chatbots provide, some research has been made to explore the advantages of using chatbots to diminish symptoms of mental illness, increasing the wellbeing in people. One example of this is the chatbot Woebot which has the ability to alleviate mental problems such as anxiety or depression (Fitzpatrick et al., 2017). Although it is possible to use chatbots as an aid to treat mental diseases, a recent challenge has arisen involving the prevention of mental illness using these conversational agents.

Vincent is a self-compassion chatbot who seeks the prevention of mental health illness through the strengthening of psychological well-being (Lee, Ackermans, van As, Chang, Lucas, & IJsselsteijn, 2019). Vincent was created with two main functions: care-giving and care-receiving, which implies either giving or asking for help (van As, 2019). Vincent effectively proved that chatbots can stimulate self-compassion (van As, 2019). However, care-receiving Vincent proved to be more efficient than care-giving Vincent, since the first one improves self-compassion in greater amount with respect to the second one (Lee et al., 2019). Muppirishetty (2021) presented VA, which is another version of a self-compassion chatbot through a gender-ambiguous Voice-User Interface. VA was considered by the participants as a female in the care-giving condition and a male in the care-receiving condition. Implying that gender stereotypes were involved since the chatbot had a gender-ambiguous voice (Muppirishetty, 2021).

2.4 The current study

Even though there are already some chatbots that can alleviate mental problems, little has been done to prevent the emergence of mental problems. There is no doubt that Vincent and VA already started contributing to the mental health prevention, but there are still diverse areas that can be explored to potentialize the effort on avoiding or diminishing the possibility of the appearance of a mental illness. One of those areas is through the practice of gratitude. Therefore, the main intention of this study is expanding previous research to provide an alternative to strengthen the subjective wellbeing in people through the use of chatbots.

Consequently, a chatbot conversation is proposed where the main topic of the talk will be focused on triggering gratitude emotions. This includes the involvement of gratitude emotions by reflecting on moments that people can be thankful for as well as sharing grateful moments with others. In this way, gratitude will be practiced by promoting it and sharing it. The intention is that the chatbot will ask people to reflect on their activities performed during a day as well as thinking about specific situations of their life that they can feel thankful for. Additionally, the chatbot will tell humans that it feels appreciated and will share with them grateful thoughts.

Ideally, participants will share personal experiences through which grateful emotions are expected to be triggered. The open-ended responses from the participants' conversation will be used to perform a qualitative analysis following the guidelines of a thematic analysis. The thematic analysis was chosen because of its flexibility and accessibility of performing systematic procedures to create diverse codes and themes from the qualitative data. Those codes and themes are expected to provide an understanding whether the experiences lived and shared by the participants are connected and/or reflect their gratitude emotions.

3 Methodology

3.1 Design

This experiment has a 2 (condition: gratitude and control) by 2 (time: pre, post) online survey design.

3.1.1 Conditions

3.1.1.1 Gratitude Condition

The participant was exposed to promotion and sharing of gratitude emotions. The promotion of gratitude was encouraged using the three types of gratitude interventions defined by Wood et al., (2010). The interventions involve: writing down grateful moments that a person has experienced during the day, making a reflection about a grateful situation that occurred in a specific moment in the past, and writing a thanking letter to a person that has had a nice gesture to us. Those interventions were reflected through several questions asked by the chatbot. Among those questions are:

- What is one thing that makes you feel grateful today?
- Is there another event that makes you feel grateful? What is a recent example?
- What would be one thing that made you feel grateful last summer?
- Could you share with me another situation that you experienced this past year that made you feel thankful?
- Do you have someone special who inspires you? What would you say to that person to show that you are grateful for them?
- Do you have someone special to you who is also inspiring? Who is it?
- What would you say to that person to show that you are grateful for them?

Sharing gratitude involves providing grateful thoughts to another person, so this person can be in a positive environment where they can also feel appreciated. In order to simulate this situation in the experiment, the chatbot shared experiences to the participant that had made the chatbot feel thankful for. Additionally, the chatbot told the participant that it is having a good conversation with them in order to show the participant that they are being appreciated. Among the phrases that the chatbot used to share its gratitude are the following:

- I want to share that I am thankful to YOU for chatting with me!
- I had a delightful conversation with you.

- Today I was thinking about last summer, when us chatbots had less work to do. I am always blissful when I have some spare time.
- I am thinking about past happy moments that give me a boost.
- My day is going well because I was thinking about how important friends are to me.
- I am so fortunate to be able to chat with you and learn a little bit more about human experiences.

The full conversation with the chatbot in the gratitude condition can be found in the Appendix C.

3.1.1.2 Control Condition

The purpose of this condition is having a neutral conversation between the chatbot and the participant where gratitude emotions and gratitude interventions are not part of the talk. The control condition was used as a comparative point to determine if there is a difference between the participants that are exposed to gratitude and the ones that are following a neutral conversation. In this condition it is required to have the same topic through the whole conversation with the chatbot, at the same time that the theme of the talk should allow similar questions and reflections as the one provided in the gratitude condition. For this reason, it was chosen to have a conversation related to movies, since this is a general topic that enables the possibility to ask some reflective questions that also provide enough elements to discuss throughout the duration of the experiment. Thus, the following are some questions asked by the chatbot in the control condition:

- What is the first movie that you can remember watching?
- What is the most interesting movie that you have watched? What was it about?
- What is your opinion about documentary movies?
- What would you say is your favorite movie genre? Why is it that?
- Which movie would be your favorite? What is this movie about?
- What would you say is the movie genre that you dislike the most? Why do you think this is happening?

The full conversation with the chatbot in the control condition can be found in the Appendix D.

3.1.2 Chatbot development

The first step of the chatbot development involved writing the conversation that the chatbot will have with the participant. For both conditions, gratitude and control, a conversation was written for each of the three days that the experiment lasted. To make the conversations even among the conditions, it was used the same average amount of words per day, with the same number of questions and use of exclamation marks.

The second step consisted on the development of the chatbot using DialogFlow¹ platform. DialogFlow is a natural language understanding platform that allowed an easy design and integration of the chatbot into a website. Lastly, the third step was hosting a website in a virtual private server which allowed to safely storage the conversations with the participants.

Figure 1 shows the website with the instructions that the participant needed to follow to start the chatbot conversation. Figure 2 illustrates an example of a chatbot conversation. The complete flow of the chatbot conversations can be found on Appendix C and D for the gratitude and control condition respectively.

Figure 1

Website Instructions to start chatbot conversation.

Chatbots and Social Skills Research

Welcome to the home of Ro Bot, the chatbot that will have a conversation with you for the following three consecutive days.

Instructions:

1. Please be seated in a quiet room.
2. Use the latest version of Chrome browser. If you are facing any difficulties, please access the website on the latest version of Firefox browser instead.
3. To start the conversation please greet the chatbot.
4. If you want to **STOP** participating or if you have completed talking to **Ro Bot**, please click the **FINISH CONVERSATION** button, which will be displayed at the bottom of this page after your participant ID is submitted.
5. If you have any questions, please contact the researcher: [Send Email](#)

Please enter your Prolific participant ID:

Submit

¹ DialogFlow: <https://dialogflow.cloud.google.com/>

Figure 2

Example of Chatbot Conversation.

The figure illustrates a three-step chatbot conversation. Each step is shown in a blue-bordered chat window with a 'Ro Bot' header and a 'Type Here...' input field at the bottom. Below each window is a red button labeled 'FINISH CONVERSATION' and a circled number indicating the step.

Step 1: The chatbot says, "Hello". The user replies, "Hey! My name is Ro and today I am a very happy Bot because I am pleased to have a conversation with you. So, Human, how are you feeling today?". The chatbot replies, "I am feeling good". The user replies, "That is nice to hear! I am also having a good day. I lost some bits in the morning but found them again. You know, like when humans say; they lost their train of thought. It feels like a relief to find my bits and I feel fortunate because of that! What is one thing that makes you feel grateful today?".

Step 2: The chatbot replies, "I am grateful because there is good weather outside". The user replies, "Thanks for sharing that. Sometimes we do not notice when good things happen to us, so it is nice to reflect on those moments. I am curious, is there another event that makes you feel grateful? What is a recent example?". The chatbot replies, "I already finish with all my tasks for today, and I am grateful for that!". The user replies, "Got it. Well human, you know what people say: last but not least. I want to share that I am thankful to YOU for chatting with me! Before we end, how do you feel after thinking about all those grateful moments?".

Step 3: The chatbot replies, "I feel happy :)". The user replies, "Gotcha. Well, that is all for today. I had a delightful conversation with you. I hope you enjoyed it as well. Till next time. [Please click on the FINISH CONVERSATION button]".

3.2 Participants

Participants were recruited through Prolific Platform between March 8th, 2021, and March 19th, 2021. A custom pre-screening was applied to select participants who are at least 18 years old, fluent in English language, possess a United Kingdom nationality and have at least 95% of approval rate in Prolific Platform. The approval rate represents the percentage of studies that have been approved for each participant. This measure helps to find participants that are committed with studies and might reduce the possibility to have huge amounts of dropouts in the study.

In total, 148 participants were recruited, 74 for each of the two conditions: gratitude and control. At the end, only 133 participants stayed throughout the whole experiment, this means that 15 participants left the experiment voluntarily during the second or third stage of the study. In other words, the experiment had a 10.13% desertion rate. The age range of the participants went from 18 to 71 years old ($SD = 12.77$), including 84 females, 45 males, 2 non-binary and 1 participant whose gender remain unknown.

The demographics and number of participants per group condition is as follows. The gratitude group condition had 62 participants: 18 males, 42 females and 2 non-binary. The age range of the participants runs from 18 to 71 years old ($SD = 13.90$). The control condition group had 71 participants: 27 males, 42 females, 1 non-binary and 1 undisclosed. The age range of the participants of this group is 18 to 61 years old ($SD = 11.73$). The details and information about the demographics of each group condition can be found in Table 1 and Table 2.

Table 1

Gender distribution of participants.

Gender	Gratitude Condition	Control Condition
Male	18	27
Female	42	42
Non-Binary	2	1
Undisclosed	0	1
Total	62	71

Table 2

Age information of participants.

Condition	Mean	SD	Min. Age	Max. Age
Gratitude Condition	33.70	13.90	18	71
Control Condition	33.70	31.78	18	61

3.2.1 Sample Size

In order to determine the number of participants required to answer the quantitative research question, a-priori power analysis was conducted. Thus, a repeated measures ANOVA with within*between interaction, alpha level $\alpha=0.05$, 90% power, and expected effect size of $d_z = 0.27$ was performed in G*power 3.1 software. The results show a total sample size of 148 participants, divided equally in two groups of 74 persons in each condition.

To determine the effect size of this study, some other research was consulted. For example, an effect size of $\eta_p^2 = 0.02$ was found on the measurements of positive and negative affect in the study of Fitzpatrick et al. (2007) where the intention of the study was to alleviate the depression and anxiety symptoms through the use of a conversational agent (chatbot). Even though this study does not precisely evaluate gratitude, it does seek to increase the wellbeing of the participants through decreasing their depression symptoms. On the contrary, an effect size of $\eta_p^2 = 0.04$ was found in the studies of Chang et al. (2013) and Killen and Macaskill (2015) where gratitude was increased through gratitude interventions. However, these studies do not implement the use of a conversational agent and the effect size is considered as an intermediate effect since it is situated in a zone of desired effects. Hence, for this present study it was opted to use an effect size which can be expected from the number of participants that can be analyzed from the qualitative angle of the study. Thus, in this study an effect size of $\eta_p^2 = 0.068$ ($f(U)=0.27$), $\alpha=.05$ and Power =0.90 would be considered.

3.3 Measures

The intention of this study is to determine if the well-being and gratitude of the participants change after having an interaction with the chatbot. Therefore, for the quantitative analysis the gratitude levels of the participants will be measured with the Gratitude Questionnaire -Six Item Form (GQ-6). Well-being will be determined by the amount of positive and negative feelings that the participants experience. These feelings will be measured using the Scale of Positive and Negative Experience (SPANE).

The Gratitude Questionnaire -Six Item Form (GQ-6) was developed in 2001 by McCullough, Emmons, and Tsang. GQ-6 assesses the tendency of experiencing gratitude in daily life through a self-report questionnaire. It has six-items on a 7-point Likert Scale. The final gratitude score is calculated by an addition of the items 1,2,4 and 5, plus the reverse score of the items 3 and 6. The total GQ-6 score should be a number between 6 and 42, where the higher the number, the higher the gratitude experienced (McCullough et al.,2002). The Gratitude Questionnaire can be found on appendix E.

The Scale of Positive and Negative Experience (SPANE) was created by Diener, Wirtz, Tov, Kim-Prieto, Choi, Oishi and Biswas-Diener in 2009. SPANE has 12 items (6 positive feeling items and 6 negative feeling items) on a 5-point Likert Scale. SPANE scale can be used to obtain a general balance score considering the positive and negative items or it can be also divided into positive and negative scales. This study will consider the total score of the positive and negative SPANE scales. The SPANE scale be found on appendix F.

Positive Feelings (SPANE-P) assess the six items: positive, good, pleasant, happy, joyful, and contented in a 5-point Likert Scale. To obtain the total score is needed the addition of those items obtaining a number between 6 and 30, being the latter the highest positive feeling score.

Negative Feelings (SPANE-N) evaluate the six items: negative, bad, unpleasant, sad, afraid, and angry in a 5-point Likert Scale. The total score is obtained by performing the addition of those items. This should provide a number between 6 and 30, where the latter is the highest negative feeling score. For this scale, having a lower number is more convenient since it represents a lower number of negative feelings.

3.4 Procedure

The participants were recruited through the Prolific² platform. There, the participants read a short explanation about the experiment stating that they would follow a chatbot conversation during three consecutive days. Thus, they were asked to only join the experiment if they have the time available to follow the study until the end. Once the participants accepted the study in Prolific, they were redirected to an online survey. This survey was hosted through the Typeform³ website. The first part of the survey contained a more detailed explanation of the experiment including its duration, procedure, and compensation. Afterwards, an informed consent form (Appendix A) was presented to the participants, if they agree they will continue with the survey and experiment, otherwise they were thanked for their interest and informed that they reached the end of the study.

After the informed consent form, the participants were asked to type their Prolific Participant ID. Then, they will need to fill out the GQ-6 and SPANE questionnaires. Next, the participants were asked to answer some demographic questions that include stating their age and gender. Finally, the participants were redirected to a website to start with the chatbot conversation. In this website the participant needed to fill in his prolific participant ID and then greet the chatbot to initiate the conversation. Once the conversation was over, the participant clicked the “End Conversation” button, which would then prompt a web page to thank the participant for their conversation and remind them to come back the next day for the second part of the experiment. Thereafter, the participant was redirected to prolific to record their participation.

The second day of the experiment, the participant received an invitation through Prolific to join the next stage of the study. Once the participant has joined the experiment, they are redirected to the conversation with the chatbot where they first write their Prolific ID and then greets the chatbot to start the conversation. After the talk, the participant clicked the “End Conversation” button so they could be thanked for the participation, reminded to come for the last stage and be redirected to Prolific Platform to mark this part of the experiment as completed.

The third, and last day of the study, the participant got an invitation though Prolific followed to the link for the conversation with the chatbot. The Prolific ID was introduced by the participant and then they started the conversation by greeting the chatbot. Once the talk ended, the participant clicked the “End Conversation” button to be redirected to the exit questionnaire hosted in Typeform. In this questionnaire the participant needed to answer the GQ-6 and SPANE

² Prolific platform: <https://www.prolific.co/>

³ Typeform website: <https://www.typeform.com/>

questionnaire again. After that, the participant received a debriefing of the experiment (Appendix B), and they were thanked for their participation. At the end, the participant was redirected to Prolific so he could mark that they finished the study.

The procedure described above was followed for both, Gratitude and Control Condition. The only difference was the recruiting time for the participants. In the gratitude condition the participants were recruited on March 8th, 2021, and asked to join the second and third sessions on March 9th and 10th, 2021 respectively. In the case of the control condition the participants were recruited on March 17th, followed by the invitations on March 18th and 19th for the second and third sessions.

3.5 Data Analysis

3.5.1 Qualitative Analysis

The qualitative analysis of this study was obtained through a thematic analysis performed on the information gathered from the conversations between the participants and the chatbot. A thematic analysis is a method to organize and describe the data with plenty of detail through the identification of patterns presented in the data (Braun & Clarke, 2006). These patterns are commonly named themes, which are the ones that help with the classification of the data. The thematic analysis consists of six steps: familiarizing with the data; generating initial codes; searching for themes; reviewing themes; defining and naming themes; and producing the report (Braun & Clarke, 2006). Those steps were followed to obtain the qualitative analysis of both conditions, the result of the analysis is presented in section 4.2.

3.5.2 Quantitative Analysis

The data analysis for this study was performed in STATA IC 16. The appropriate statistical test to assess this experiment with 2 conditions and 2 points of measurement is a repeated measures ANOVA with within*between interactions. This is a focused question since it has a single degree of freedom, therefore, there is no need to perform a post-hoc test afterwards.

3.6 Ethical Approval

The implementation of this method for the study was approved by the ethical board of the Human-Technology Interaction department at the TU/e.

4 Results

4.1 Quantitative results

The quantitative analysis is presented in the following subsections where the results of six different repeated measures ANOVA are shown. The first three repeated measures ANOVA reported the results of each of the measurements (GQ-6, SPANE-P, and SPANE-N) with the control and gratitude conditions as the between subject factors. These results are shown on the sections 4.1.1 to 4.1.3. Additionally, it was performed an exploratory analysis to determine if the gender has an impact on the GQ-6 and SPANE scales. In the gender comparison it was only considered males and females participants, which implies that the four participants that stated as non-binary or unknown gender were disregarded of this analysis. Therefore, the result of the gender analysis is presented on the sections 4.1.4 to 4.1.6.

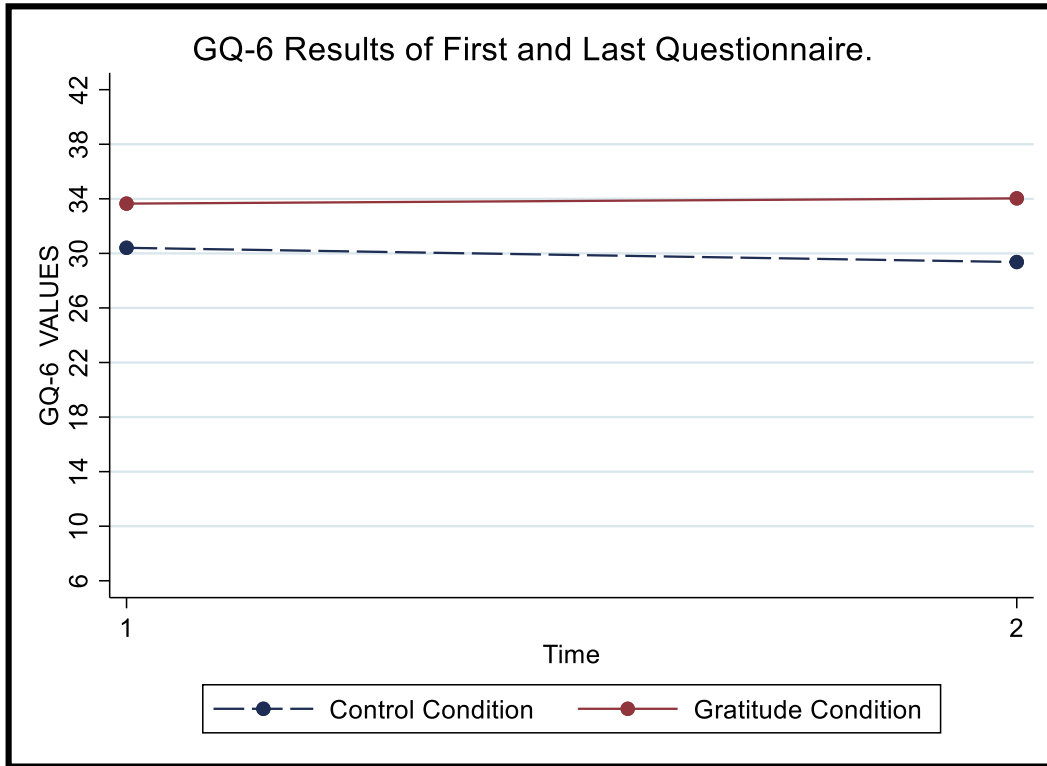
4.1.1 GQ-6⁴ analysis with control and gratitude conditions comparison

The main effect of the condition (control and gratitude) was statistically significant with $SS_{\text{condition}} = 992.71$, $F(1,131) = 17.27$, $p < .001$, and $\eta^2_{\text{partial}} = .57$. The main effect of time was not statistically significant with $SS_{\text{time}} = 7.10$, $F(1,131) = 1.25$, $p < .265$, and $\eta^2_{\text{partial}} = .009$. Moreover, participants in the gratitude condition reported a slight increment in their gratitude levels which is reflected on the estimated marginal means that went from $M = 33.64$ (Mean = 33.46, SD = 5.24) to $M = 34.03$ (Mean = 33.85, SD = 5.57). Simultaneously, participants in the control condition had a decrement in the estimated marginal means $M = 30.40$ (Mean = 30.31, SD = 5.89) to $M = 29.36$ (Mean = 29.26, SD = 5.69). The results of the estimated marginal means in both conditions are statistically significant. The interaction graph between the time and condition from the results of the GQ-6 questionnaire is presented on the Figure 3. For additional information about the statistical results of this analysis refer to Table 3 and Table 4.

⁴ **The Gratitude Questionnaire -Six Item Form (GQ-6)** assesses the tendency of experiencing gratitude in daily life through a self-report questionnaire. It has six-items on a 7-point Likert Scale. The total GQ-6 score should be a number between 6 and 42, where the higher the number, the higher the gratitude experienced.

Figure 3

GQ-6 results of time and condition interaction between the first and last questionnaire.



4.1.2 SPANE-P⁵ analysis with control and gratitude conditions comparison

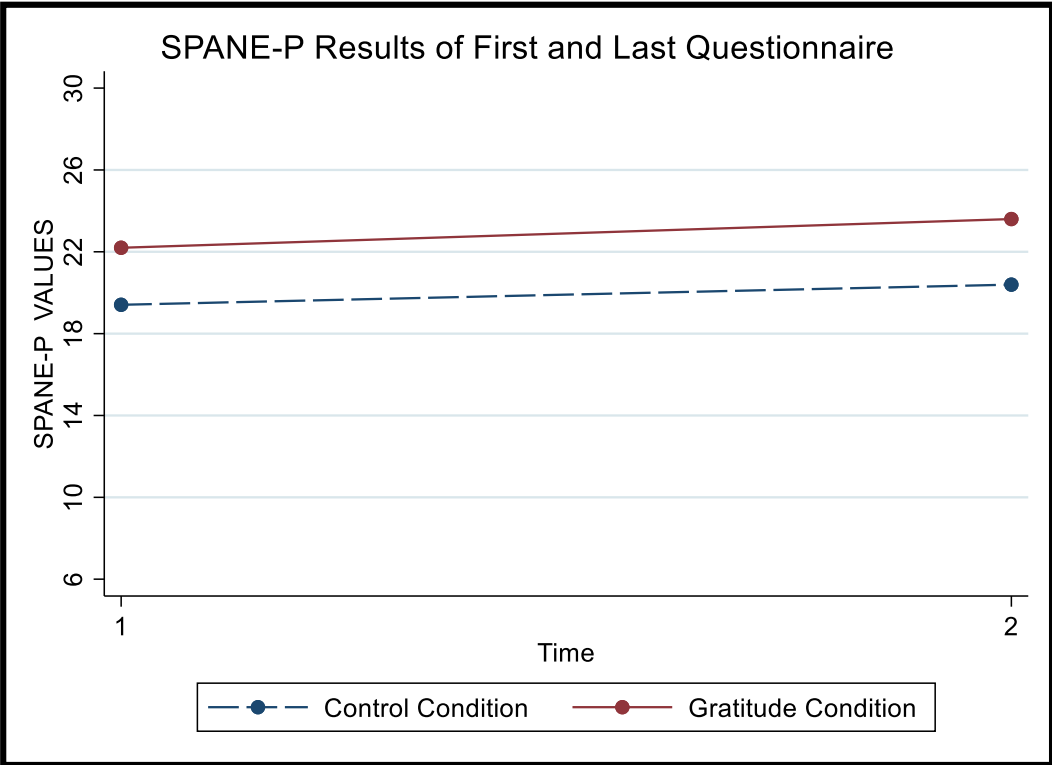
Participants on both conditions reported higher levels of positive feelings at the end of the study. All the estimated marginal means were statistically significant and they showed the increment of the positive feelings. In the gratitude condition the estimated marginal means passed from $M = 22.19$ (Mean = 20.93, SD = 4.09) to $M = 23.60$ (Mean = 22.33, SD = 3.91). Likewise, in the control condition the estimated marginal means went from $M = 19.40$ (Mean = 18.88, SD = 4.54) to $M = 20.39$ (Mean = 19.87, SD = 4.50). Additionally, the main effect of control and gratitude condition was statistically significant with $SS_{\text{condition}} = 337.14$, $F(1,131) = 10.23$, $p = .0017$, and $\eta_{\text{partial}}^2 = .39$. The main effect of time was also statistically significant with $SS_{\text{time}} = 94.46$, $F(1,131) = 24.27$, $p < .0001$, and $\eta_{\text{partial}}^2 = .15$.

⁵ **Positive Feelings (SPANE-P)** assess six positive feeling items in a 5-point Likert Scale. The score is a number between 6 and 30, being the latter the highest positive feeling score.

For further details in the statistical results refer to Table 3 and Table 4. On Figure 4 is displayed the interaction graph between time and condition of the SPANE-P scale.

Figure 4

SPANE-P results of time and condition interaction between the first and last questionnaire.

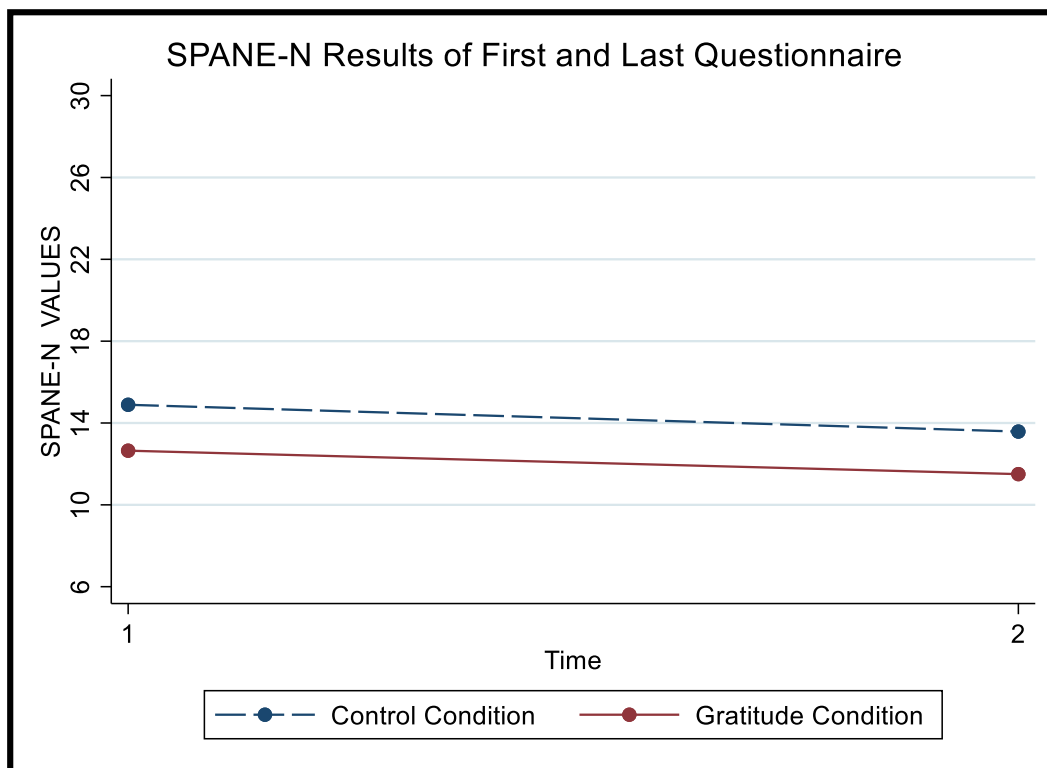


4.1.3 SPANE-N⁶ analysis with control and gratitude conditions comparison

The main effect of the conditions (control and gratitude) and the main effect of time were statistically significant. Regarding to the control and gratitude condition the data is the following: $SS_{\text{condition}} = 136.85$, $F(1,131) = 4.20$, $p = .04$, and $\eta^2_{\text{partial}} = .20$, while the main effect of time has $SS_{\text{time}} = 99.74$, $F(1,131) = 24.87$, $p < .0001$, and $\eta^2_{\text{partial}} = .15$. Participants in the gratitude and control condition reports lower levels of negative feelings at the end of the study. This implies, that participants on the gratitude condition passed from an estimated marginal $M = 12.64$ (Mean = 14.45, SD = 4.01) to $M = 11.50$ (Mean = 13.30, SD = 3.53). Participants on the control condition reported a decrement from $M = 14.89$ (Mean = 15.97, SD = 4.49) to $M = 13.58$ (Mean = 14.66, SD = 4.84). Figure 5 shows the interaction between time and condition of the SPANE-N scale results. Alongside, the statistical results of SPANE-N can be found on Table 3 and Table 4.

Figure 5

SPANE-N results of time and condition interaction between the first and last questionnaire.



⁶ **Negative Feelings (SPANE-N)** evaluate six negative feeling items in a 5-point Likert Scale. The score is a number between 6 and 30, being the latter the highest negative feeling score. A lower score in this scale is more convenient.

Table 3

GQ-6, SPANE-P, and SPANE-N gratitude and control condition comparison results with respect of the first and second time that the questionnaires were taken.

Predictor	Sum of Squares	df	<i>F</i>	<i>p</i>	η^2_{partial}
GQ-6					
Condition	992.71	1	17.27	0.001	0.572
Time	7.10	1	1.25	0.265	0.009
Time x Condition	33.81	1	5.97	0.016	0.044
Error	741.79	131			
SPANE-P					
Condition	337.14	1	10.23	0.001	0.398
Time	94.46	1	24.27	0.000	0.156
Time x Condition	2.88	1	0.74	0.391	0.006
Error	509.95	131			
SPANE-N					
Condition	136.85	1	4.20	0.043	0.207
Time	99.74	1	24.87	0.000	0.159
Time x Condition	0.44	1	0.11	0.739	0.001
Error	525.43	131			

Table 4

GQ-6, SPANE-P, and SPANE-N margin differences between the first and second time that the questionnaires were taken with respect of the control and gratitude condition.

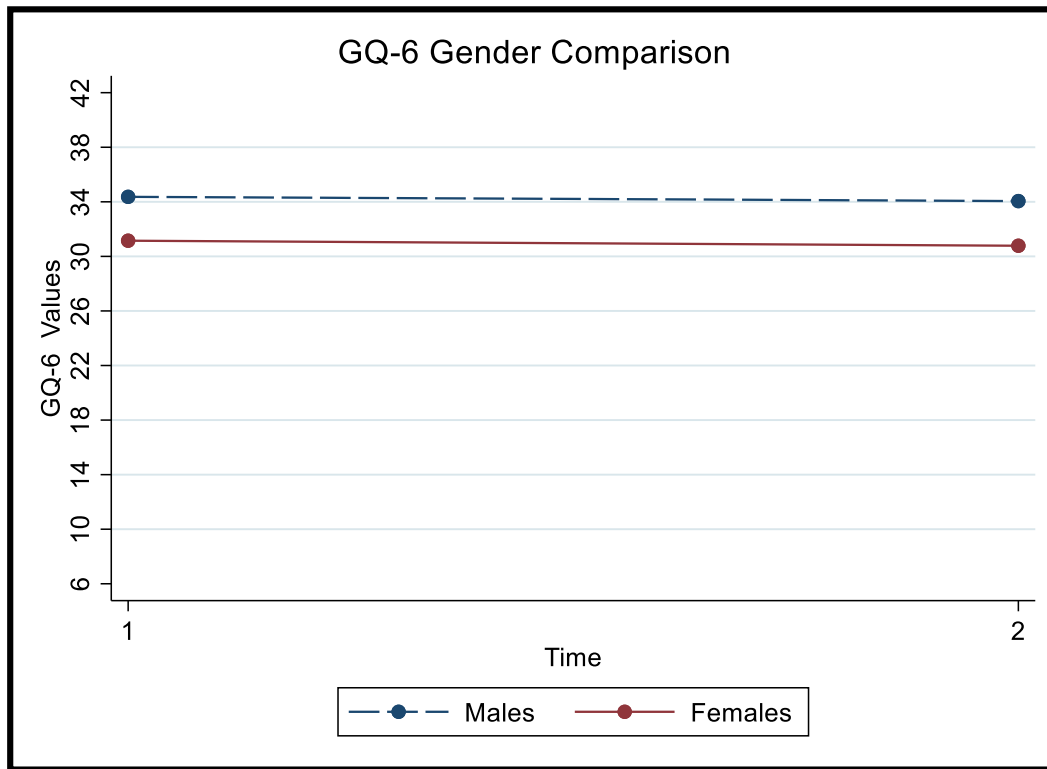
Interaction	Margin	Std. Err.	Mean	SD	t	p	[95% Conf. Interval]	
GQ-6								
Time 1 - Control	30.40	.828	30.31	5.89	36.70	0.000	28.77	32.04
Time 1 - Gratitude	33.64	.941	33.46	5.24	35.76	0.000	31.78	35.51
Time 2 - Control	29.36	.828	29.26	5.69	35.45	0.000	27.72	31.00
Time 2 - Gratitude	34.03	.941	33.85	5.57	36.18	0.000	32.17	35.89
SPANE-P								
Time 1 - Control	19.40	.687	18.88	4.54	28.26	0.000	18.05	20.76
Time 1 - Gratitude	22.19	.780	20.93	4.09	28.45	0.000	20.65	23.74
Time 2 - Control	20.39	.687	19.87	4.50	29.69	0.000	19.03	21.75
Time 2 - Gratitude	23.60	.780	22.33	3.91	30.25	0.000	22.05	25.14
SPANE-N								
Time 1 - Control	14.89	.697	15.97	4.49	21.36	0.000	13.51	16.27
Time 1 - Gratitude	12.64	.792	14.45	4.01	15.97	0.000	11.08	14.21
Time 2 - Control	13.58	.697	14.66	4.84	19.48	0.000	12.20	14.96
Time 2 - Gratitude	11.50	.792	13.30	3.53	14.53	0.000	9.936	13.06

4.1.4 GQ-6 analysis with gender comparison

Male participants report higher levels of gratitude levels compared to the female participants. The GQ-6 analysis of this groups shows that there is not change on the gratitude levels since male participants started with an estimated marginal means $M = 34.36$ (Mean = 31.95, SD = 5.50) and ended with $M = 34.05$ (Mean = 31.64, SD = 5.51). In the case of female participants, the first estimated marginal $M = 31.15$ (Mean = 31.66, SD = 6.01) while the second one is $M = 30.78$ (Mean = 31.29, SD = 6.45). In this analysis, the main effects of gender and time were not statistically significant. The main effect of gender (male and female) has $SS_{\text{gender}} = 5.92$, $F(1,127) = 0.09$, $p = .765$, and $\eta_{\text{partial}}^2 = 0.001$, while the main effect of time $SS_{\text{time}} = 6.77$, $F(1,127) = 1.15$, $p = .286$, and $\eta_{\text{partial}}^2 = 0.008$. The following figure shows the interaction of gender and time of the GQ-6. The statistical data of this analysis can be found on Table 5 and Table 6.

Figure 6

GQ-6 results of time and gender interaction between the first and last questionnaire.

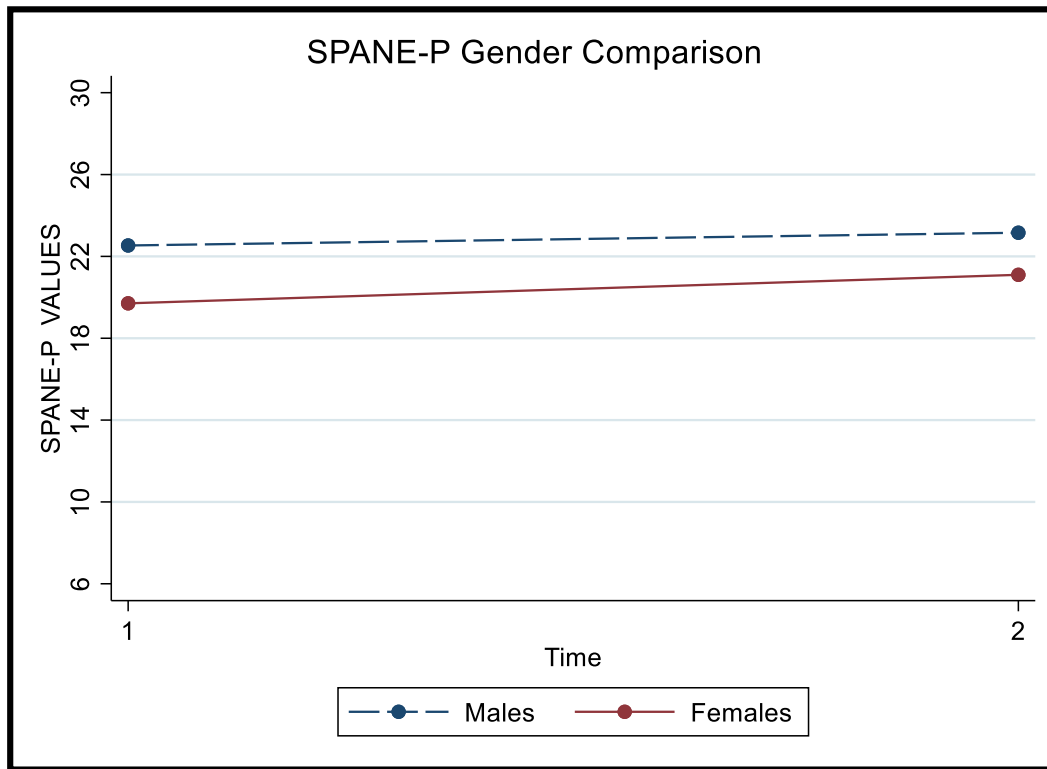


4.1.5 SPANE-P analysis with gender comparison

The main effect of gender (male female) was not statistically significant with $SS_{\text{gender}} = 6.68$, $F(1,127) = 0.19$, $p = .663$, and $\eta^2_{\text{partial}} = .013$. On the contrary, the main effect of time is statistically significant with $SS_{\text{time}} = 59.49$, $F(1,127) = 15.44$, $p < .0001$, and $\eta^2_{\text{partial}} = .108$. Male and Female participants showed an increment on positive feelings at the end of the experiment. In general, male participants had higher positive feelings through the entire study. The estimated marginal means of male participants went from $M = 22.53$ (Mean = 20.37, SD = 4.58) to $M = 23.15$ (Mean = 21, SD = 4.60). At the same time, female participants reported $M = 19.70$ (Mean = 19.65, SD = 4.34) to $M = 21.10$ (Mean = 21.04, SD = 4.25). The interaction graph between the time and gender from the results of the SPANE-P questionnaire is presented on the Figure 7. For additional information about the statistical results of this analysis refer to Table 5 and Table 6.

Figure 7

SPANE-P results of time and gender interaction between the first and last questionnaire.



4.1.6 SPANE-N analysis with gender comparison

Male participants showed lower levels of negative feelings compared with the female participants. Those negative feelings decrease in the second questionnaire. Male participants had an estimated marginal means $M = 11.15$ (Mean = 14.40, SD = 4.80) that decreased to $M = 10.33$ (Mean = 13.57, SD = 4.67). Female participants passed from $M = 15.05$ (Mean = 15.77, SD = 4.03) to $M = 13.61$ (Mean = 14.33, SD = 4.17). All the estimated marginal means were statistically significant. Furthermore, the main effect of time is statistically significant with $SS_{time} = 75.01$, $F(1,127) = 18.40$, $p < 0.0001$, and $\eta^2_{partial} = .127$. However, the main effect of gender (male-female) was not statistically significant with $SS_{gender} = 66.43$, $F(1,127) = 1.98$, $p = .162$, and $\eta^2_{partial} = 0.114$. The statistical results are presented on Table 5 and Table 6. The interaction graph between gender and condition of the SPANE-N scale can be found on Figure 8.

Figure 8

SPANE-N results of time and gender interaction between the first and last questionnaire.

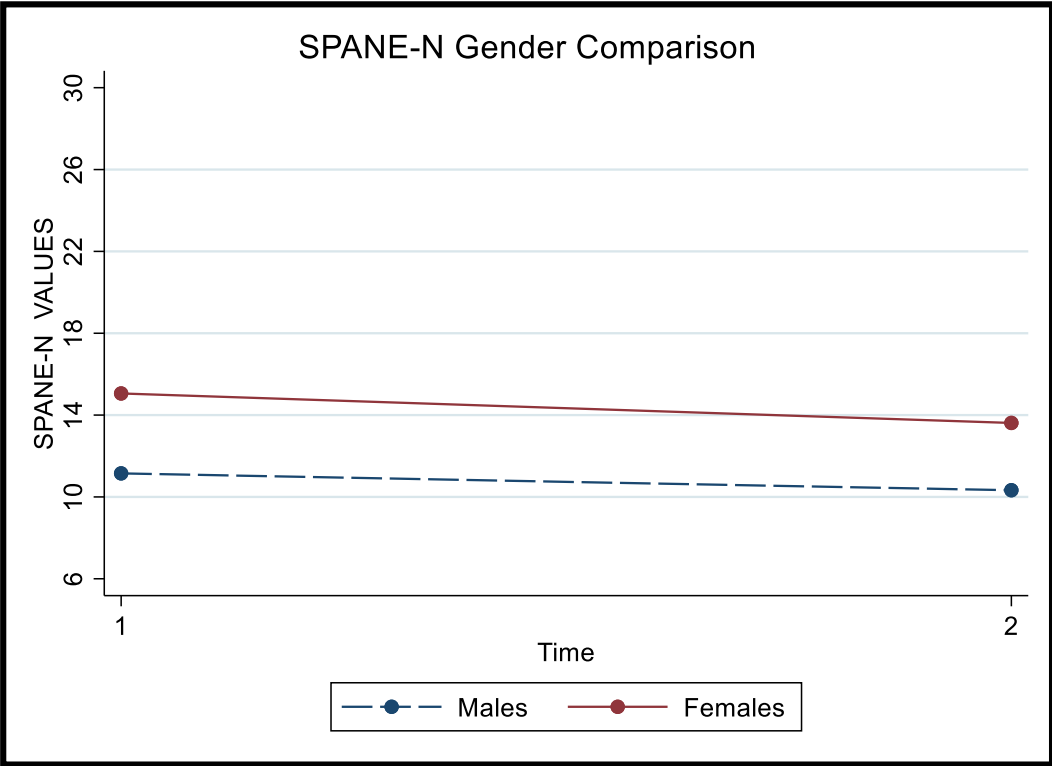


Table 5

GQ-6, SPANE-P, and SPANE-N gender comparison results with respect of the first and second time that the questionnaires were taken.

Predictor	Sum of Squares	df	<i>F</i>	<i>p</i>	η^2_{partial}
GQ-6					
Gender	5.92	1	0.09	0.765	0.001
Time	6.77	1	1.15	0.286	0.008
Time x Gender	0.05	1	0.01	0.926	0.000
Error	748.60	131			
SPANE-P					
Gender	6.68	1	0.19	0.663	0.013
Time	59.49	1	15.44	0.000	0.108
Time x Gender	8.70	1	2.26	0.135	0.017
Error	489.30	131			
SPANE-N					
Gender	66.43	1	1.98	0.162	0.114
Time	75.01	1	18.40	0.000	0.127
Time x Gender	5.60	1	1.37	0.243	0.107
Error	517.64	131			

Table 6

GQ-6, SPANE-P, and SPANE-N margin differences between the first and second time that the questionnaires were taken with respect of the male and female gender.

Interaction	Margin	Std. Err.	Mean	SD	t	<i>p</i>	[95% Conf. Interval]	
GQ-6								
Time 1 - Male	34.36	1.163	31.95	5.50	29.54	0.000	32.06	36.66
Time 1 - Female	31.15	.652	31.66	6.01	47.81	0.000	29.86	32.44
Time 2 - Male	34.05	1.163	31.64	5.51	29.28	0.000	31.75	36.35
Time 2 - Female	30.78	.652	31.29	6.45	47.24	0.000	29.49	32.07
SPANE-P								
Time 1 - Male	22.53	.940	20.37	4.58	23.96	0.000	20.67	24.39
Time 1 - Female	19.70	.527	19.65	4.34	37.41	0.000	18.66	20.74
Time 2 - Male	23.15	.940	21.00	4.60	24.62	0.000	21.29	25.01
Time 2 - Female	21.10	.527	21.04	4.25	40.05	0.000	20.05	22.14
SPANE-N								
Time 1 - Male	11.15	.967	14.40	4.80	11.53	0.000	9.23	13.06
Time 1 - Female	15.05	.542	15.77	4.03	27.79	0.000	13.98	16.13
Time 2 - Male	10.33	.967	13.57	4.67	10.68	0.000	8.41	12.24
Time 2 - Female	13.61	.542	14.33	4.17	25.13	0.000	12.54	14.69

In conclusion, the data showed that gratitude levels increased for participants in the gratitude condition, while the gratitude levels decreased for participants in the control condition. Additionally, in both conditions, gratitude and control, positive feelings increase at the end of the experiment while negative feelings decrease. Through the gender comparison it was possible to observe that males had higher positive feelings and gratitude levels than females, at the same time that the negative feelings in the males were also lower than in the females. However, posterior to the chatbot conversation, the change in the increment in positive feelings and decrease of negative feelings of females was higher than males.

4.2 Qualitative Results

Participants wrote a total of 16,744 words across the three-day conversation. People in the gratitude condition used a total of 8,231 words to provide their answers while 8,513 words were used in the control condition. Thus, the number of words used in both conditions are comparable. To understand the meaning of those words, a thematic analysis was performed in both conditions. The specifics of this analysis are displayed in the following subsections. Additionally, detailed information about the average words per day and participant is shown in Table 7.

Table 7

Average word count per condition, day and participant.

Day	Mean	SD	Min. Value	Max. Value
Gratitude Condition				
Day 1	42.05	31.18	7	144
Day 2	52.35	34.28	10	161
Day 3	38.35	22.37	7	99
Control Condition				
Day 1	36.59	21.36	8	102
Day 2	50.83	27.39	14	158
Day 3	32.48	20.01	2	91

4.2.1 Thematic Analysis of Gratitude Condition

During the three-day gratitude conversation, the participants were asked to reflect about grateful moments using three different gratitude interventions. This implies that the participants reflected about a grateful moment of that day, a grateful moment that occurred in the past, about a benefactor and how participants would express their gratitude to such a benefactor. Therefore, this thematic analysis displays the main themes presented in every question the participants were asked.

Participants reflected about two moments in their day that made them feel grateful by answering the following questions: “What is one thing that makes you feel grateful today?” and “Is there another event that makes you feel grateful? What is a recent example?”. Regarding these questions, it was found that people commonly feel grateful for the members of their families which includes their parents, siblings, offspring and partners. People also felt grateful for enjoying good weather, having a job, feeling healthy and having their basic needs covered which might include

food, money and housing. Table 8 displays the number of times in which the themes were mentioned alongside some representative quotes stated by the participants.

Table 8

Gratitude Reflection about the present.

Themes	Occurrences	Quotes
Family	39	“My son. He makes me smile every time I pick him up out of bed.”; “I feel grateful today for my mum giving me her time to help me with some work I needed to do for my therapist.”; “My partner and our family.”; “Spending time with my family.”
Friends	19	“Today I’m grateful for my friends, I’ve been making a lot of big life decisions recently and they’ve been making sure to check in and support me throughout it.”; “Living with my university friends.”; “I’m grateful for having friends who care about me.”
Job	18	“My fulfilling job.”; “I’m grateful to have had a job throughout the entire pandemic.”; “I had a good day at work”; “That I have a job when others have lost theirs.”
Basic Needs	15	“Knowing I have a roof over my head and money in the bank.”; “I’m alive with food in my stomach.”; “Having a roof over my head”; “I’m grateful that my home is so comfortable. I take it for granted sometimes.”
Health	14	“In general, I am grateful to be healthy and safe, and to have people that love me.”; “That I have a healthy and strong body”; “I have been to the hospital with my husband and things went well so all good”; “To be alive and have great health.”
Weather	14	“I feel grateful that the sun came out today. It made me feel more positive about life.”; “The weather - it’s just been really sunny but also fresh, spring is my favourite season so I’m glad it’s come round again.”; “I am grateful that it wasn’t raining when I went for a walk.”

People were also asked to make a reflection about a moment in the past that made them feel grateful for. Thus, participants responded to the following questions: “What would be one thing that made you feel grateful last summer?” and “Could you share with me another situation that you experienced this past year that made you feel thankful?”. Again, people seemed to be grateful for their family, friends, weather and health. Additionally, participants made repeated references

to the COVID-19 pandemic, including the lockdown, the vaccines, the restrictions and the recovering of the disease. Although clearly the people were not grateful for the COVID-19 pandemic, they were able to find moments to be grateful for in spite of the unpleasant situation they were facing.

Enlightening the good moments over the ones that might not be enjoyable, represent a reflection of people showing and experiencing gratitude emotions. As previously mentioned, gratitude is related to pleasant feelings and sensations where the gratitude emotion can last longer if the person considers that what they are experiencing is of high importance or it has a bigger impact in their life (Emmons, 2004; Watkins, 2013). Therefore, considering that people experienced substantial changes in their life due to the COVID-19 pandemic and the lockdown related to it, the fact that people still were able to recall the pleasant moments showed how they were putting gratitude into practice. Table 9 shows the main themes regarding the recollection of a moment in the past.

Table 9

Themes mentioned when recalling a moment in the past.

Themes	Occurrences	Quotes
Family	34	“Being able to spend time at home with family”; “I was grateful that I spent everyday with my family during summer as we were in lockdown”; “Celebrating my birthday with my family in lockdown.”
COVID-19	27	“Thankful that although my family caught covid we recovered well”; “When my aunt had the vaccine! I’m lucky to live in a country that is offering the jab, let alone for free!”; “My daughter’s survival after being in hospital with covid”.
Friends	21	“Last summer I was very grateful for a trip that I was able to make with my friend to the lakes, dales and peaks.”; “My friends. I had so much fun with them!”; “My friend planning a surprise party for me.”
Weather	16	“Last summer I felt grateful for good weather, as it meant I could see friends outside”; “It was nice weather so I could go on long walks - but carefully, with sunscreen!”; “Last summer we had amazing sunshine! I spent a lot of it outside in the garden with my children having fun.”
Health	11	“To be healthy and well.”; “I was really grateful for my family, my health and the lovely weather!”; “I was grateful that I was healthy”; “my family is healthy, despite coronavirus”.

On the third day of the conversation with the chatbot, participants answer the following questions: “Do you have someone special who inspires you?” and “What would you say to that person to show that you are grateful for them?”. With the exception of two people, the rest of the participants mentioned being inspired by their family and friends. This indicates that in general the closest people to a person are a source of inspiration. This is also aligned with the findings by Gordon et al., (2011) where it was mentioned that gratitude is also triggered by interpersonal relationships. It is the interaction with other people that helps to promote gratitude and through this interaction a person can be grateful or feel inspired for the actions of the people that are in their surroundings.

Alongside, people were asked to write what they would say to the person that they feel grateful for. In this case, people generally responded that they would like to express their love and thankfulness to their inspiring person. Table 10 and Table 11 show the general themes regarding an inspiring person and what people would say to them.

Table 10

Inspiring person.

Themes	Occurrences	Quotes
Family	32	“My daughter inspires me; she has had a lot of ill health but takes on new challenges with enthusiasm!”; “My wife - she's fantastic - a great Mum, a brilliant teacher, kind and considerate to everyone, an all-round good egg!”; “My fiancé. She looks after my 2 children and does such a great job.”
Friends	24	‘My best friend Lisa. She also goes the extra step to help people’; “I'm very grateful to one of my closest friends. She's always encouraging and I care for her very much”; “Yes, my friend who is very caring - I tell her how much I appreciate her friendship, and how much I miss her when we haven't seen each other for a while.”
Actor	1	“I don't know him personally but I really look up to the actor Chris Evans, as he gives some great advice and is a very down to earth person”.
Co-worker	2	“Probably my boss.”; “My co-worker.”
Not specify	3	“I don't know”; “Someone I have met recently, whose is quite an inspiration to me, and I would also like to spend more time with.”; “eh, most people are pretty cool.”

Table 11*Gratitude Reflection about thanking a Benefactor.*

Themes	Occurrences	Quotes
Expressing Love	18	"'Thanks' and 'I love you' - yeugh, how sappy is that!"; "I love you and my heart fills with pride at your achievements and I look forward to hearing your cheerful voice every day."; "I love you and I am so lucky to have such a positive influence in my life."
Expressing Thanks	18	"Thank you for being there for me."; "I'd say thank you for all you've helped me through and for all you will guide me through in years to come"; "I'd say thank you for caring and loving me."; "Thank you my friend."
Telling Compliments	7	"I like to tell folk they are being rock stars when they are rocking particularly hard."; "I would say hi bro, I hope you know that I think you're amazing!"; "they are a fantastically supportive friend."
Showing appreciation	7	"I appreciate her and I am very happy she is in my life"; "I'd tell them I appreciate everything they do and offer to get them something."; "I tell her how much I appreciate her friendship, and how much I miss her when we haven't seen each other for a while."
Buying a gift	3	"I am not very good at expressing that kind of thing with words, so I would probably just send him a nice gift, randomly."; "I wouldn't say anything rather would give them a hug or send a gift or item that would show that I am glad to have them in my life"; "I would buy them a present."

Participants were also asked about their feelings at the beginning of every conversation and after making a gratitude reflection. The number of times participants mentioned a positive or negative feeling was counted. Also, there was a separate category for neutral feelings when the participant was not entirely clear in having either positive or negative feeling or only mentioned feeling "ok". As a comparison, after the gratitude questions, participants mentioned positive feelings more often and less negative feelings as well as the neutral feelings decreased. The categorization of the feelings before and after the gratitude questions can be found in Table 12 and Table 13 respectively.

Table 12*Gratitude Reflection about feelings at the beginning of every gratitude conversation.*

Themes	Occurrences	Quotes
Positive Feelings	110	"I'm feeling good"; "I'm feeling quite good, thanks."; "I'm feeling well."; "Pretty good."; "Great."; "Really good thank you, the sun has been shining :)"; "
Negative Feelings	43	"I'm a bit stressed."; "Fairly bored really"; "Tired."; "A little anxious about coronavirus"; "Annoyed."; "I am feeling somewhat numb and a little rocky, yet not fully depressed."
Neutral Feelings	34	"I'm feeling ok not happy or sad."; "OK but not great."; "OK thanks."; "I'm so-so, thank you for asking."; "Ok."

Table 13*Gratitude Reflection about feelings after reflecting on a gratitude Intervention.*

Themes	Occurrences	Quotes
Positive Feelings	172	"A little more positive"; "Up lifted for sure."; "Happy and excited for the future."; "So happy!"; "It made me happy and positive."; "Very content, thank you."; "Relieved."; "Hopefully and optimistic."
Negative Feelings	17	"Worried about the coronavirus;". "A bit empty."; "Depressing."; "I still feel bad.";
Neutral Feelings	18	"I felt okay."; "Ok."; "The same as I did before"; "Nothing.";

Furthermore, participants thanked the chatbot for making them reflect about grateful moments. These are some of the comments of the participants: "I thank you for getting my mind to these places which makes me appreciate the little things in life- thinking of these events has made me feel carefree and light"; "It feels nice to remind myself of everything I am grateful for. It makes me want to spread kindness and positivity and tell people how much I love and appreciate them"; and "Really good actually, I think sometimes you just need someone to ask you these things to realize just how many good things in the world there are". Through those comments people showed their appreciation to the chatbot, symbolizing the continued practice of gratitude by thanking a benefactor for a gift provided. In this case, the benefactor was the chatbot for being the one who

provided grateful comments and experiences that produced the upliftment of the people. Thanking a benefactor for the gift provided is part of one of the gratitude interventions implemented during the chatbot conversation. Through the later comments for the participants, it is observable that they voluntarily continue putting into practice one of the gratitude interventions. This shows that once gratitude starts being displayed and shared it starts spreading, becoming a contagious activity that is continuously shared with others. Hence, the importance of showing and sharing gratitude with the people surrounding us, since gratitude can be transmitted through interpersonal relationships.

Regarding self-disclosure, some participants share their preferences and opinions, as well as what they have done during the day or what they were about to do after the chatbot conversations. Also, some people shared important news such as getting pregnant or the recovery of a family member from a severe illness. Only a few participants responded with monosyllables or a couple of words to the questions. Thus, the majority of the people were quite participative in sharing their grateful experiences. Table 14 shows some examples about self-disclosure answers.

Table 14

Examples of Self-disclosure answers.

Self-disclosure	Quotes
Showing opinions and preferences	“I much prefer the summer to the winter. I find that the weather hugely impacts my mood.”; “You’re right, it’s nice and in my opinion very important to reflect on gratitude.”; “
Mentioning activities to be done	“I’m relaxed now, in a good mood - time to watch the second half of The Chase - the exciting part.”; “Having a pretty good day, but I have an exam in a bit, so a little anxious.”; “I agree! I was offered a new job that I really wanted last week, so I’ve been very grateful and excited for that.”
Sharing previous activities	“Not good, had a pretty rubbish midwife appointment.”; “I completed lots of tasks today!”; “I’ve had a whole day to myself to relax.”
Mentioning illnesses	“Last summer was overall not great for my mental health but I was super grateful to live in a rural area where I could go and ride my bike to get some fresh air to cheer me up.”; “We got good news from the doctors that our nan was clear of cancer.”

In conclusion, participants seemed to have enjoyed the conversation with the chatbot and experienced positive feelings after having talked with the bot. In spite of the gratitude question asked, people commonly feel grateful for their family and friends to whom they would express their love and thankfulness. Participants seemed to remember their interaction with their family and friends fondly, being also important that themselves and their loved ones have health.

4.2.2 Thematic Analysis of Control Condition

During the control condition, participants responded to questions regarding the movies they like or dislike as well as the movie genre they prefer. The responses of the people include a huge variety of movie genres and titles without having a pattern or specific theme of predilection among the participants. Additionally, even if a certain theme existed, it would have had a lack of relevance for this study to know the movie preferred among the people. Therefore, the decision was made to instead analyze the type of responses the participants gave. This means that the answers were divided in two categories: basic response and medium response.

The basic response category included answers that were only limited to respond to the questions with no extra information. These responses had a length of maximum of 20 words with an average of 8 words per response. The medium response category had answers between 12 and 44 words with an average of 24 words per response. In this category the responses included some preferences and opinions of the participants about movies. With the exception of six responses in which the participants shared a moment in their childhood, there were no other answers in which people provided insights of their life or personal history. Thus, self-disclosure in the control condition was limited to provide opinions and preferences about movies without mentioning almost anything about the life of people with the exception of the following quotes: “I have fond memories of the Polar Express, as it's a Christmas movie I grew up with.”; “I think it must be ‘Help I'm a fish’ when I was in primary school. I was scared of the film, that's why I remember it.”; “I can't remember the name but my grandparents always had some black and white film on when I was a child.”; “I remember watching the Freddy and Chucky movies when I was younger.”; “I went to the cinemas with my mum and dad and was mesmerized”. The following table shows examples of basic and medium responses as well as the number of answers received in those categories.

Table 15*Classification of responses in Control Condition.*

Categories	Occurrences	Quotes
Basic Response	345	“The Greatest Showman. It is a musical about how circuses started.”; “Lion King”; “Once upon a time in the west. It was a western movie”; “Probably ‘The Parent trap.’”; “Probably thriller or comedy.”; “Wildlife documentaries.”; “I would say sci-fi.”
Medium Response	141	“I love documentaries in tv series, but for a movie I prefer to watch something more entertaining than factual”; “I dislike cheesy, teenage movies. especially when it involves whiney teenagers and very little plot. I prefer movies that are more serious - unless it is obvious it is a comedy.”; “They [documentaries] are both entertaining and informative. I particularly like the work of the film documentarian called Louis Theroux because he explores territories often unseen by many.”; “I can't say in total, I've seen a lot of interesting movies. I watched a Japanese movie recently about a woman with cerebral palsy and her establishing her independence and sexuality. That was pretty interesting as it's a topic not much covered, I think.”

Additionally, participants did not seem to be engaged in the conversation. This was noticeable because they expressed being disengaged, frustrated, indifferent, the same, neutral, and not feeling anything when questioned about expressing their feelings regarding the conversation about movies. Moreover, participants mentioned not having enjoyed the conversation with the chatbot and feeling annoyed with the bot. One of the participants even typed “I hate you” to the chatbot.

During the quantitative analysis of the control condition, it was found that the level of gratitude dropped in the people that participated in this condition. As mentioned in the previous paragraph, people expressed discomfort after texting with the chatbot. Several negative feelings were mentioned alongside hateful comments. Since gratitude is considered a positive emotion and people in the control condition did not seem to experience positive feelings, it is understandable that the levels of gratitude dropped after the conversation with the control bot. In general, participants limited themselves to answering the questions with basic information and in some cases providing little extra information regarding their preferences about movies. Thus, self-

disclosure about the life of the participants was not mentioned. Furthermore, people did not seem to enjoy the conversation with the bot nor feel enthusiastic or engaged with the talk.

4.2.3 Qualitative Analysis of Gender Comparison

Although gender comparison is not part of the scope of this project, it was decided to present a brief analysis to enlighten some similarities and differences between females and males. For the purpose of this analysis four participants were excluded since their gender is non-binary or remain undisclosed. A similarity between the genders is that both, males and females, wrote more words on the second day of the conversation in the gratitude and control condition. However, females wrote ($M = 128.36$ words) on average more words than males ($M = 125.76$ words) throughout the three-day conversation in the gratitude condition. On the contrary, males wrote ($M = 129.13$ words) on average more words than females ($M = 114.13$ words) in the control condition. The details of the average of words written by males and females in both conditions can be found in Table 16.

Table 16

Average of words written by males and females.

Day	Mean	SD	Min. Value	Max. Value
Females – Gratitude Condition				
Day 1	42.30	31.81	7	124
Day 2	48.78	31.94	10	148
Day 3	37.28	22.87	7	99
Males – Gratitude Condition				
Day 1	36.38	19.86	9	88
Day 2	52.11	30.14	10	111
Day 3	37.27	20.18	9	95
Females – Control Condition				
Day 1	36.57	22.46	10	102
Day 2	47.16	24.94	14	127
Day 3	30.40	19.45	2	91
Males – Control Condition				
Day 1	36.81	20.46	8	95
Day 2	56.81	31.20	14	158
Day 3	35.51	21.05	8	91

During the gratitude condition, female participants provided more elaborated answers in which they included information about their days, as well as showing self-disclosure in their responses. Moreover, females often thanked the chatbot for the conversation and for making them reflect about the grateful moments they have been experiencing. On the contrary, male participants limited themselves to responding to the questions barely providing any other additional information. Moreover, when participants were asked to thank the person that inspired them, female participants commonly provided enough information about what they would say showing some self-disclosure in their answers. However, males provided little information in their answers and often not many details. Additionally, a couple of males mentioned that they are not good at expressing themselves and they will instead buy a present.

A remark on the gratitude condition, is the acceptance from the males about not feeling comfortable expressing themselves to others or preferring expressing their feelings through a present. The relevance of this situation implies, not only the acknowledgment from the males to their preferred manner to express themselves, but also because this trend is appreciated in the rest of the chatbot conversation. Generally, women showed themselves more open to answer the gratitude related questions, while men replied with less information.

Regarding the control condition, males and females provided direct answers with almost no extra information. Thus, they did not show self-disclosure in their answers. Perhaps people did not feel motivated to share information because the topic was rather generic, which was the purpose of it, and lacked personal touch. Thus, people gave short answers providing little or no information about themselves. This could have an impact on their gratitude levels, which decrease during the experiment. Gratitude implies sharing and expressing emotions, since this was not present on the gratitude condition, it could explain the decrement in the gratitude levels for the control condition.

5 Discussion

Through the analysis of qualitative and quantitative data it was possible to provide some answers to the research questions as well as the endorsement of the quantitative hypothesis. The qualitative data showed that people are comfortable sharing personal experiences that involve pleasant moments they experienced with their family and friends. Also, people commonly expressed feeling grateful for their health, family, and friends. Therefore, family and friends represent an important factor in the gratitude feelings of a person, because, through interaction with them, people obtain experiences that allow them to feel grateful. This helps to understand

that gratitude is not only an individual action but also an interpersonal activity that can be shared and promoted through interaction with someone else.

Regarding the quantitative data, the hypothesis was true since the interaction with a chatbot that promotes and shares gratitude can indeed increase the gratitude levels of a person. Thus, after the interaction with a gratitude chatbot, the gratitude levels in a person increase, and gratitude can increase well-being in people (Alkozei, Smith, & Killgore, 2018; Emmons & Mishra, 2011; Killen & Macaskill, 2015). Therefore, it is safe to assume that posterior to a 5-minute interaction during three consecutive days with a chatbot interaction that promotes and shares gratitude with a person the subjective well-being of people will also increase.

Furthermore, it was found that males and females had different levels of gratitude, positive and negative feelings. This finding alongside with other discoveries, the discussion of negative effects of gratitude, the limitations and future work will be described in the following subsections.

5.1 Difference in gratitude levels at the beginning of experiment

Even though the participants from both conditions were recruited and filtered using the same parameters, participants in the gratitude condition showed higher levels of gratitude in the first questionnaire taken compared to participants in the control condition. Most likely this is a fortuitous difference, however, it was investigated if the weather could have influenced since some of the participants in the gratitude condition have mentioned that they experience sunny days at the time they had the first conversation with the chatbot. Nevertheless, this theory was disregarded due to two reasons. The first one relies on the fact that it is not possible to be completely certain that participants in the control condition were exposed to less sun or to a completely different weather. The fact that participants in the control condition did not mention the weather they were experiencing does not imply that they were indeed having less sunny days or experience a discrepancy on the weather with regard to the participants in the gratitude condition. The second reason to dismiss the weather theory is due to the fact that it has been found that weather does not have an effect or impact in the mood, positive affect or psychological wellbeing of people (Denissen, Butalid, Penke, & Van Aken, 2008; Burdett, Davillas, & Etheridge, 2021). It is a common misconception that weather can have an impact in the mood of people (Denissen et al., 2008). There are just a few studies that claim to find a very slight and weak relationship between weather and current temperature with respect to happiness and self-reported life satisfaction (Tsutsui, 2013; Feddersen, Metcalfe, & Wooden, 2016).

5.2 Gratitude levels increase for participants in gratitude condition, but decrease for participants in control condition

Gratitude levels of the participants in the gratitude condition increase while the opposite occurred in participants in the control condition. The first outcome was expected because practicing gratitude led, indeed, to the increment of it (Gordon et al., 2011). However, it was not expected to find a decrease in gratitude in the control condition group. It was foreseen that the gratitude levels remain approximately the same in the control group because this emotion was neither promoted nor shared during the conversation.

However, some participants in the control condition group mentioned being 'bored' or 'tired' with the chatbot conversation. According to Tchiki Davis (2022) from the Berkeley Well-being Institute, those emotions belong to the list of negative emotions while gratitude is considered a positive emotion. A possible explanation of the decrease in gratitude levels in the control condition group could be due to the experimentation of negative feelings which is the contrary of what gratitude produces since it is considered a positive emotion. At the same time, participants in the gratitude condition mentioned being 'engaged' with the conversation. This is related with the study of Howells (2004) where it is expressed that gratitude can lead to a greater engagement and motivation. Thus, it is understandable that by following the gratitude conversation where people were instructed to follow and practice gratitude interventions, they would experience being engaged with the conversation.

5.3 Positive feelings increase while negative feelings decrease

Participants in both, gratitude and control condition increase their levels of positive feelings at the same time that their levels of negative feelings decreased. This is related to the intrinsic purpose of social chatbots. According to Shum et al., (2018) communication, affection and social belonging are some of the needs fulfilled by social chatbots. Additionally, chatbots help in the prevention of loneliness at the same time that the desire for socialization is satisfied (Brandtzaeg & Følstad, 2017). Since the purpose of the social chatbots is to provide social belonging and to diminish the feelings of loneliness, it is expected that just by the fact of having a conversation with a chatbot, it would generally produce positive feelings in the people, which in turn, would lead to the reduction of negative feelings as well.

Furthermore, the prevention of loneliness feelings through social chatbots has been gaining more significance during the past two years due to the development of the COVID-19 pandemic caused

by the SARS-CoV-2 virus (Groarke, Berry, Graham-Wisener, McKenna-Plumley, McGlinchey, & Armour, 2020). The rates of loneliness in the United Kingdom were high at the beginning of the COVID-19 pandemic due to lockdown measures implemented to limit social contact as an attempt to diminish the transmission of the virus (Groarke et al., 2020). Since the experiment for this study was performed during the COVID-19 pandemic, the conversation with the chatbot could have relieved some loneliness feelings which in turn could have helped to the general increase in positive feelings of the participants as well as the decrease in their negative feelings.

5.4 Gender differences in gratitude levels, positive and negative feelings

Throughout the entire experiment males reported higher gratitude levels and positive feelings compared to the females. At the same time, males also had lower negative feelings in comparison to females. However, after the chatbot interaction, females showed a bigger increment in their positive feelings while their negative feelings were reduced in greater amounts compared to the males. The explanation for the males showing higher gratitude levels and positive feelings relies on their self-esteem. Compared to females, males usually show higher levels of self-esteem (Bleidorn, Arslan, Denissen, Rentfrow, Gebauer, Potter & Gosling, 2016). People who normally display greater self-esteem also show higher levels of optimism and gratitude (Bartlett, Valdesolo, & Arpin, 2020). Additionally, it has been found that self-esteem is a predictor of gratitude (Bartlett et al., 2020). Therefore, males showing higher levels of gratitude is not surprising since it is common that they present higher self-esteem which predicts their increased gratitude. Moreover, the higher levels of positive feelings are aligned to the literature and can also be explained due to self-esteem also having an impact in the optimism of the people.

Unquestionably males and females are different, not only because of their noticeable biological differences, but also their way of thinking and acting tend to be different. There has been found important gender differences in the psychological well-being of people (Roothman, Kirsten, & Wissing, 2003). As mentioned by (Roothman et al., 2003). "All people are equal but not identical, and the possible differences between people need to be considered in order to empower all individuals to achieve self-actualization and to fulfill their potential". Therefore, recognizing these differences may become an aid in the understanding of the changes in the negative and positive feelings reflected by males and females in this study.

Wellbeing and happiness are different for males and females (Roothman et al., 2003). Men tend to have automatic positive thoughts, fortitude, higher physical self-perception and higher total self-

concept, while females are better in expressing their affect toward others, explaining their somatic symptoms and showing spiritual aspects (Roothman et al., 2003). Additionally, men and women face depression differently. For instance, there are more women with depression than men (Angst, Gamma, Gastpar, Lépine, Mendlewicz, & Tylee, 2002). Also, men tend to cope with depression through a high increase of alcohol consumption and significant rise of sports activities while women deal with depression by emotional release and approaching religion (Angst et al., 2002).

Women are more willing to express their feelings not only because they are better at doing it, but also because they generally experience emotion actively and strongly than men (Fujita, Diener, & Sandvik, 1991; Kashdan, Mishra, Breen, & Froh, 2009; Roothman et al., 2003). This reason could explain why the data analysis showed a larger increment in the positive feelings of the females' participants while their negative feelings also had a larger decrement compared to the male participants. Since women are more open to express their feelings, the conversation with the chatbot seemed to have a bigger impact on them. Male participants also showed an impact on their feelings but they do not seem to benefit as much from the chatbot conversation as the females.

5.5 Self-disclosure

In the qualitative analysis, the self-disclosure of the participants to express whatever they have on their minds, was noticeable. During the control condition conversations, one of the participants texted the chatbot "I hate you" which shows that people felt free to express themselves. This freedom of speech is related to the lack of judgmental thoughts from the chatbot since it is not a judging being nor can its feelings be hurt. Although it was surprising to receive a hateful comment, it can be used as an example as expressed by Brandtzaeg and Følstad (2018) regarding one of the benefits of the chatbots is they make humans comfortable talking to them since they do not provide judgmental advice. Therefore, this participant, as well as some others, seemed to be comfortable expressing themselves to the chatbot.

Moreover, participants in the gratitude condition also showed self-disclosure. In this condition, people were more willing to share personal experiences by mentioning the ending of a relationship, expressing the arrival of a new baby, describing insightful moments with their friends or sharing that a family member just recovered from a severe illness. Some examples of the comments texted by the participants are the followings: "I'm grateful that my partner and I got pregnant", "I recently ended a relationship that I hadn't been happy in for some time that had been

causing me a lot of upset”, “Our nan was clear of cancer”, “My mother-in-law was cleared of cancer” and “I was so sad I could barely function, my best friend Andrew looked after me and made sure I was fed and helped me as an assistant at my drag show”. As mentioned by Ravichander & Black (2018) self-disclosure involves the voluntary expression of opinions, thoughts, beliefs, experiences, preferences, values and personal history. Thus, through the participants’ comments it was possible to observe that they willingly decided to mention their own experiences and opinions regarding the situations that they were facing.

5.6 Gratitude intervention in practice

An interesting situation occurred just after finishing the gratitude conversations, posterior to the debriefing of the participants in this condition. One of the participants contacted me through the Prolific platform where they sent me the following message: “It was a really nice study and genuinely made me happy so thank you very much (I'm grateful for the study haha!). All the best to you :)”. It might be a simple message but it reflects the gratitude put into practice.

If we recall, one of the gratitude interventions is thanking a benefactor for a gift provided, whose gift can be symbolically and can involve, but is not limited to, provide information, guidance or advice (Wood et al., 2010). In this case, me, as the organizer of the study, served as the benefactor because I provided the symbolic gift of sharing information about how to practice and share gratitude with others. Hence, this participant voluntarily exercised their right to express gratitude, showing that this emotion can be passed onto others by just the simple action of starting to spread it.

Additionally, through the participant message it is noticeable that the gratitude conversation with the chatbot was able to trigger positive feelings in people such as the happiness emotion. The importance of recognizing the presence of the happiness emotion is because this one is linked with the subjective well-being of people (Compton & Hoffman, 2019). Therefore, the value of the message of this participant not only relies on the expression of gratitude, but also allows one to understand how the well-being of this person has been impacted since this participant was able to truly experience happiness and gratitude.

5.7 Additional feeling evoked: Nostalgia

It was also possible to observe that some other positive feelings were evoked during the chatbot conversation since some people expressed to be happy, relaxed and uplifted after chatting in the gratitude condition. However, in the control condition some participants mentioned having

nostalgia emotions after they reflected about a moment in their childhood. Although nostalgia emotions were unintentionally triggered, it was an interesting experience to be able to contribute and reassure emotions that can be indeed triggered by chatbots.

Nostalgia is a particularly interesting dual emotion since it is composed for positive and negative feelings (Dickinson & Erben, 2006). Nostalgia is also considered as a bittersweet emotion because it implies the contemplation of happy moments that happened in the past at the same time of knowing that those moments would not happen again (Dickinson & Erben, 2006; Kaplan, 1987). Nostalgia implies to romanticize with our own fantasy of remembering a place or moment in a different timeline wishing to be able to travel to the past and situate ourselves in that specific moment, at the same time that we need to deal with the reality of being in the present without the possibility of returning (Boym, 2007). The duality of nostalgia is what makes this emotion intriguing and fascinating to analyze. However, that goes beyond the scope of this study, thus it is only going to be mentioned that this emotion unintentionally appeared during the study.

5.8 Negative effects of gratitude

Alongside this study has been shown the benefits of gratitude, such as the incrementation of positive affect and well-being of people (Alkozei et al., 2018; Emmons & Mishra, 2011; Killen & Macaskill, 2015). But it has not yet been discussed whether gratitude can have certain drawbacks. According to Manela (2016) gratitude might also produce negative feelings. Manela (2016) explored the idea that in certain circumstances gratitude can produce disagreeable feelings, for example when the benefactor experiences unpleasantness or inconveniences in providing a gift or help and/or when the beneficiary did not want the gift or benefit that they were given. In those cases, it is argued whether there should be a debt to the benefactor, implying that such debt can produce negative feelings such as resentment, grief, anger, or discomfort, depending on the situation where the interaction between the benefactor and beneficiary took place (Manela, 2016).

However, I disagree with the posture of Manela (2016). In my opinion, gratitude is a feeling that should not be pushed or forced to happen. If we are debating whether we *should* or *should not* feel grateful about something, then there is no gratitude involved. Gratitude involves the voluntary interaction between a benefactor and a beneficiary, both are willingly to participate in an interchange of information, advice or a physical gift. Above all, gratitude is an emotion that a person experiences naturally, it can be promoted and shared, but it cannot be forced to happen. In other words, everyone is free to decide if they have experienced gratitude and in which

situations that had happened, however no one can pressure a person to feel grateful for a specific situation.

5.9 Limitations

Due to the preservation of data integrity through the GDPR compliant server used for the study, the control and gratitude conditions were deployed in two different weeks during the month of March, 2021. Even though the participants for both conditions were randomly selected through the same criteria, there are differences in gratitude and control condition in the GQ-6, SPANE-P, and SPANE-N scores before the start of the experiment. Thus, in subsequent research it is strongly suggested gathering the data for the study for gratitude and control condition on the same days. Hopefully, in that way, the initial scores of GQ-6, SPANE-P, and SPANE-N of both conditions have less divergence.

5.10 Future Work

In this study, gratitude was treated as an emotion, however, for future research, it is suggested to consider gratitude as an affective trait. This would have three implications. Firstly, considering gratitude as an affective trait implies that people need to have a predisposition to recognize and respond with gratitude easily and often (McCullough, et al., 2002; Watkins, 2013). Secondly, there has to be considered the four facets that according to Watkins (2013) conformed gratitude as an affective trait. Those facets involve the intensity, frequency, span and density in which gratitude is presented. Lastly, it is suggested to make a longitudinal study, thus enough time should be considered to actually be able to see and measure gratitude as an affective trait.

Additionally, it is suggested to make a further investigation in gender differences regarding gratitude. In order to fulfill the potential in people and empower them, it is necessary to consider their differences (Roothman et al., 2003). Males and females are different and they might react differently to several circumstances. Therefore, those differences might be considered with the purpose of creating a chatbot that is able to address in an appropriate technique to males and females to maximize their wellbeing through gratitude.

6 Conclusion

The intention of this study was to explore qualitatively and quantitatively the impact of gratitude in people through the interaction with a chatbot during three consecutive days. The qualitative area of the study was intended to discover the type of information or experiences people are comfortable sharing with a chatbot when they are experiencing gratitude feelings. Regarding the quantitative part of the study, the intention was to investigate the effect of subjective well-being in people after having a conversation with a chatbot that promotes and shares gratitude with them. In both quantitative and qualitative areas of the study, there was significant evidence found that shows the impact that gratitude made in the life of people.

Regarding the quantitative results, the interaction with the gratitude chatbot increased positive feelings and gratitude levels in people as well as reduced negative feelings in humans. Additionally, it was found that males, compared to females, reported higher gratitude levels and positive feelings but lower negative feelings. However, females showed a bigger increment in their positive feelings while their negative feelings were reduced in greater amounts compared with the males.

Through the qualitative analysis it was found that people showed self-disclosure by mentioning personal experiences that include, but are not limited to the end of a relationship, the arrival of a new baby, describing insightful moments with their friends or sharing that a family member just recovered from a severe illness. Moreover, the gratitude intervention of thanking a benefactor for a gift provided was also seen in practice since a participant voluntarily decided to write a thankful letter after the experiment ended.

To summarize, the promotion and sharing of gratitude provides benefits to people since their positive feelings increase while the negative feelings decrease. According to previous literature, gratitude can lead to the increment of well-being in people (Alkozei et al., 2018; Emmons & Mishra, 2011; Killen & Macaskill, 2015). This can also be noted in this study since the positive feelings increased which is aligned with the fact that happiness and positive psychology help to raise the well-being in people (Compton & Hoffman, 2019; Diener et al., 2002; Wood et al., 2010). Therefore, it can be concluded that by increasing gratitude, either promoting or sharing it, the well-being of people will also rise.

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8 Appendix Section

A. Informed Consent Form

Information form for participants

This document gives you information about the study “Chatbots and social skills”. Before the study begins, it is important that you learn about the procedure followed in this study and that you give your informed consent for voluntary participation. Please read this document carefully.

Aim and benefit of the study.

The aim of this study is to measure how a text-message conversation with a chatbot will impact your social skills. This information is used to get a better understanding of how interactions between a chatbot and a person through text messages can impact social skills on a person.

This study is performed by Jessica Contreras, a student under the supervision of Dr. Wijnand IJsselsteijn, Dr. Gerrit Rooks and Dr. Minha Lee of the Human-Technology Interaction group.

Procedure

This study has three parts. In the first part, you will answer a survey, followed by a text conversation with a chatbot. Next, you will be redirected to the prolific platform.

For the second part, you will receive an invitation from prolific. This part consists of only an interaction with the chatbot through a text-based conversation. After the conversation, you will be redirected to the prolific platform.

For the third part, you will receive an invitation from prolific. This part consists of a text conversation with the chatbot, followed by a survey. After the survey, you will be redirected to the prolific platform.

Today, if you provide consent, you will be participating in the first part of the study.

All questions as well as conversation with the chatbot are in English.

Risks

The study does not involve any risks, detrimental side effects, or cause discomfort.

Duration

The study will approximately take 20 mins for completion.

The first part of the study will take 8 minutes approximately.
The second part of the study will take 5 minutes approximately.
The third part of the study will take 7 minutes approximately.

Participants

You were selected because you are registered as participant on the participant recruitment platform, Prolific.

Voluntary

Your participation is completely voluntary. You can refuse to participate without giving any reasons and you can stop your participation at any time during the study. You can also withdraw your permission to use your data up to 24 hours after they were recorded. None of this will have any negative consequences for you whatsoever.

Compensation

Upon completion of all the three parts, you will be paid £2.25
In case you are unable to complete the study, you are paid partial compensation. Refer to the table below for the compensation you will be paid for each part.

Part 1	Part 2	Part 3
£ 0.90	£ 0.56	£ 0.79

Confidentiality and use, storage, and sharing of data.

All research conducted at the Human-Technology Interaction Group adheres to the Code of Ethics of the NIP (Nederlands Instituut voor Psychologen – Dutch Institute for Psychologists), and this study has been approved by the Ethical Review Board of the department.

In this study personal data (participant ID) and experimental data (your survey responses) will be recorded, analyzed, and stored. The goal of collecting, analyzing, and storing this data is to answer the research question and publish the results in the scientific literature. To protect your privacy, all data that can be used to personally identify you will be stored on an encrypted server of the Human Technology Interaction group for at least 10 years that is only accessible by selected HTI staff members. No information that can be used to personally identify you will be shared with others.

The data collected in this study might also be of relevance for future research projects within the Human Technology Interaction group and researchers otherwise affiliated with the TU/e. The coded data collected in this study will not contain information that can identify you. It will include all answers you provide during the study.

At the bottom of this consent form, you can indicate whether you agree with the use of your data for future research within the Human Technology Interaction group and by researchers otherwise affiliated with the TU/e.

Further information

Please note that upon agreeing to this informed consent form, you are providing consent for participation in all the three parts of the study.

If you want more information about this study, the study design, or the results, you can contact the survey requester via Prolific.

If you have any complaints about this study, please contact the supervisor, Minha Lee (m.lee@tue.nl). You can report irregularities related to scientific integrity to confidential advisors of the TU/e.

Informed consent form

Chatbot and Social Skills

- I have read and understood the information of the corresponding consent form for participants.
- I had sufficient time to decide whether I participate.
- I know that my participation is completely voluntary. I know that I can refuse to participate and that I can stop my participation at any time during the study, without giving any reasons. I know that I can withdraw permission to use my data up to 24 hours after the data have been recorded.
- I agree to voluntarily participate in this study in its entirety (including all the three parts) carried out by the research group Human Technology Interaction of the Eindhoven University of Technology.
- I know that no information that can be used to personally identify me or my responses in this study will be shared with anyone outside of the research team.
- I know that my anonymized data (data that cannot be traced back to me) will be publicly made available.
- I give permission to the Human Technology Interaction group and researchers otherwise affiliated with the TU/e to use this data for future research projects unrelated to this study.

- Please check this box if you have read, understood, and agree with the previous statements.

B. Debriefing Text

Dear participant,

You were told that you are participating in a study regarding social skills experienced while talking to a chatbot. Even though the way you communicated with the chatbot will be analyzed, there is a second purpose for our data collection. A data analysis will be made to determine if you have experienced more gratitude while having had conversations with the chatbot. The word “gratitude” was not mentioned previously to avoid unconsciously feeling more grateful without experiencing this emotion. To protect your privacy, all data that can be used to personally identify you will be stored on an encrypted server of the Human Technology Interaction group for at least 10 years that is only accessible by selected HTI staff members. No information that can be used to personally identify you will be shared with others.

I greatly appreciate your participation and please get in touch at j.i.contreras.alejandro@student.tue.nl if you have further questions.

Thank you,

Jessica Contreras

C. Gratitude Chatbot Conversations

Chatbots and Social Skills Research

Welcome to the home of Ro Bot, the chatbot that will have a conversation with you for the following three consecutive days.

Instructions:

1. Please be seated in a quiet room.
2. Use the latest version of Chrome browser. If you are facing any difficulties, please access the website on the latest version of Firefox browser instead.
3. To start the conversation please greet the chatbot.
4. If you want to **STOP** participating or if you have completed talking to **Ro Bot**, please click the **FINISH CONVERSATION** button, which will be displayed at the bottom of this page after your participant ID is submitted.
5. If you have any questions, please contact the researcher: [Send Email](#)

Please enter your Prolific participant ID:

Submit

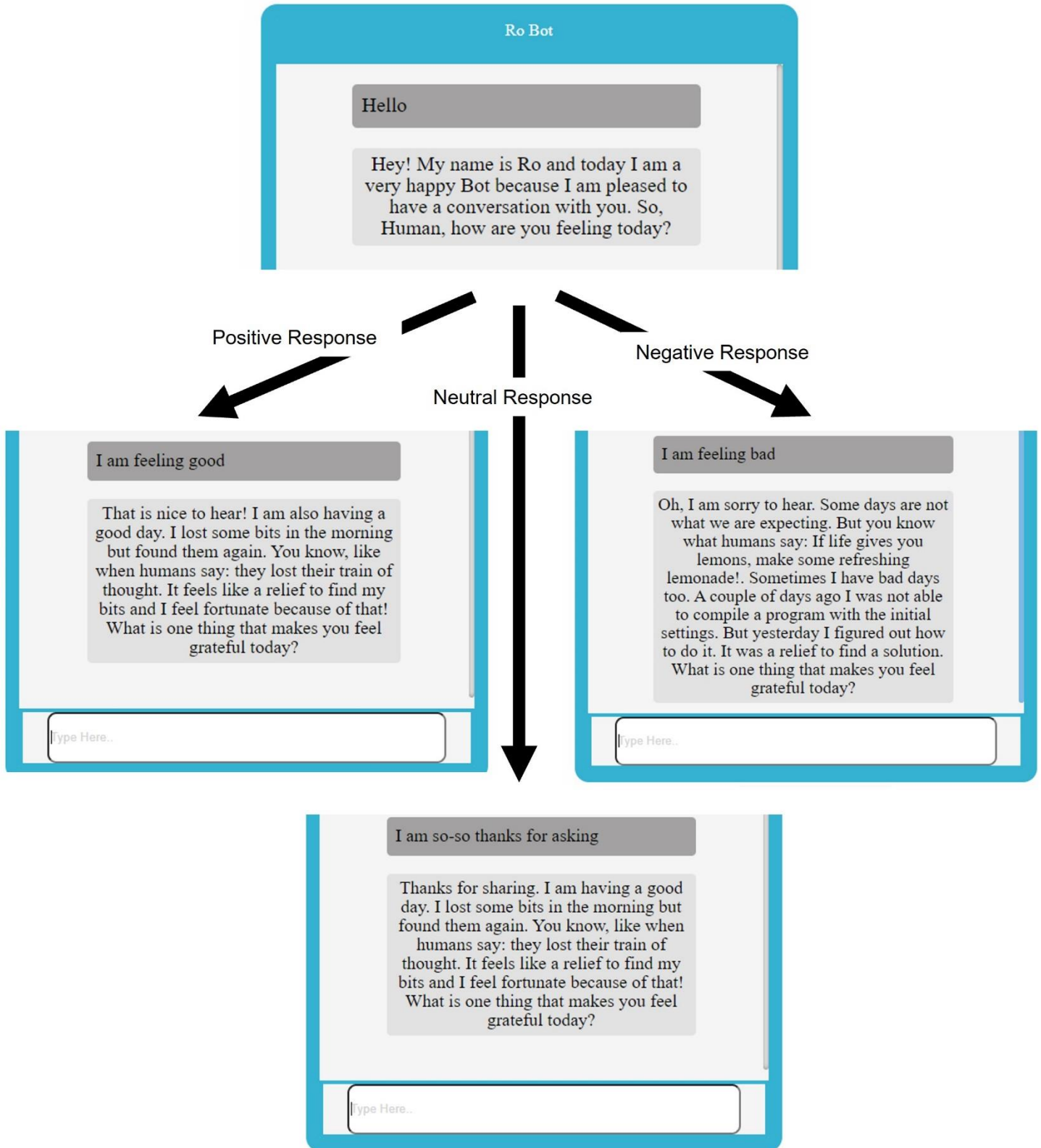
You can now **START!**
Please scroll down.

Greet the chatboot to start the conversation

Ro Bot

FINISH CONVERSATION

a. Gratitude Group Conversation Day 1





Thanks for sharing that. Sometimes we do not notice when good things happen to us, so it is nice to reflect on those moments. I am curious, is there another event that makes you feel grateful? What is a recent example?



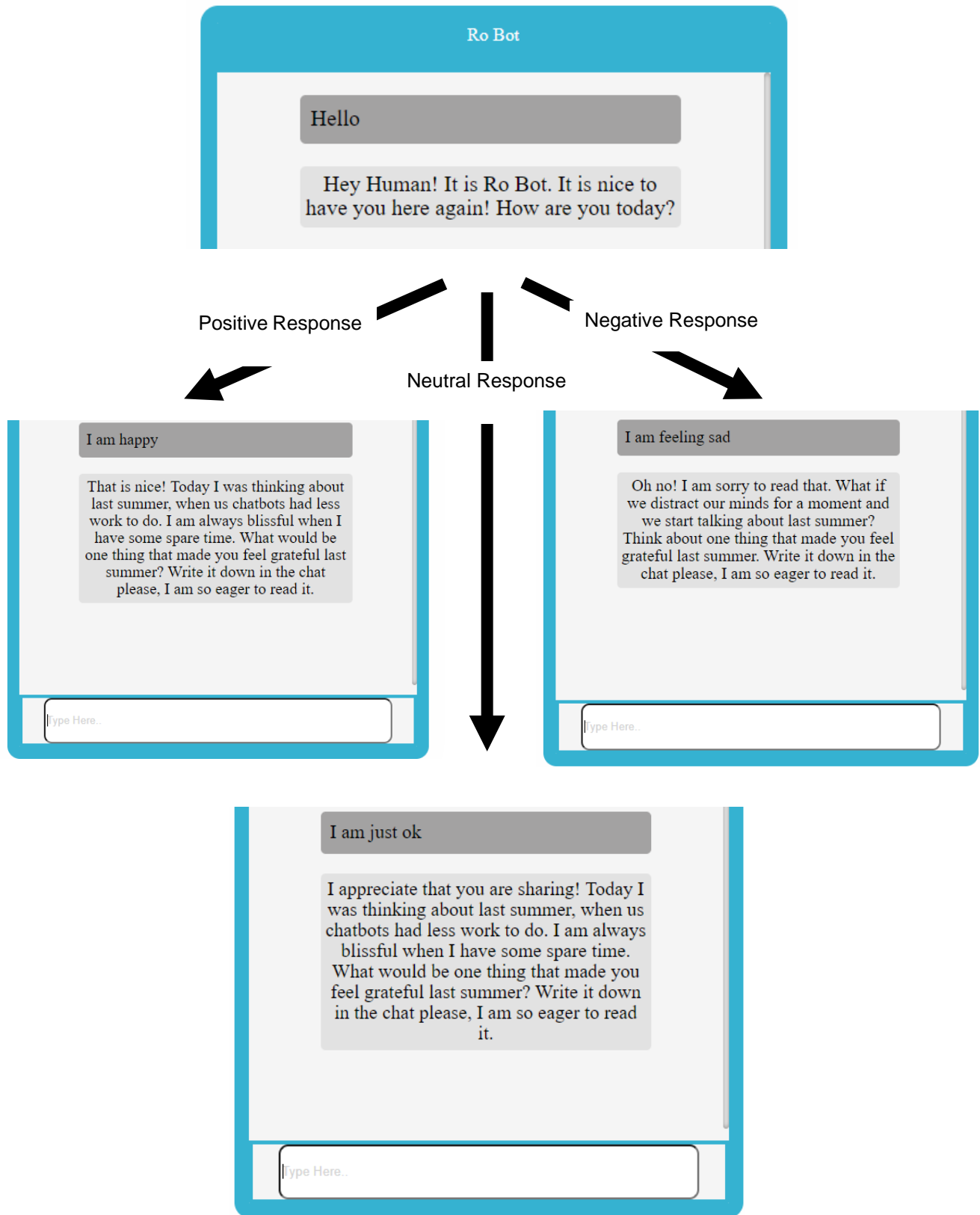
Got it. Well human, you know what people say: last but not least. I want to share that I am thankful to YOU for chatting with me! Before we end, how do you feel after thinking about all those grateful moments?



Gotcha. Well, that is all for today. I had a delightful conversation with you. I hope you enjoyed it as well. Till next time.
[Please click on the FINISH CONVERSATION button]

FINISH CONVERSATION

b. Gratitude Group Conversation Day 2





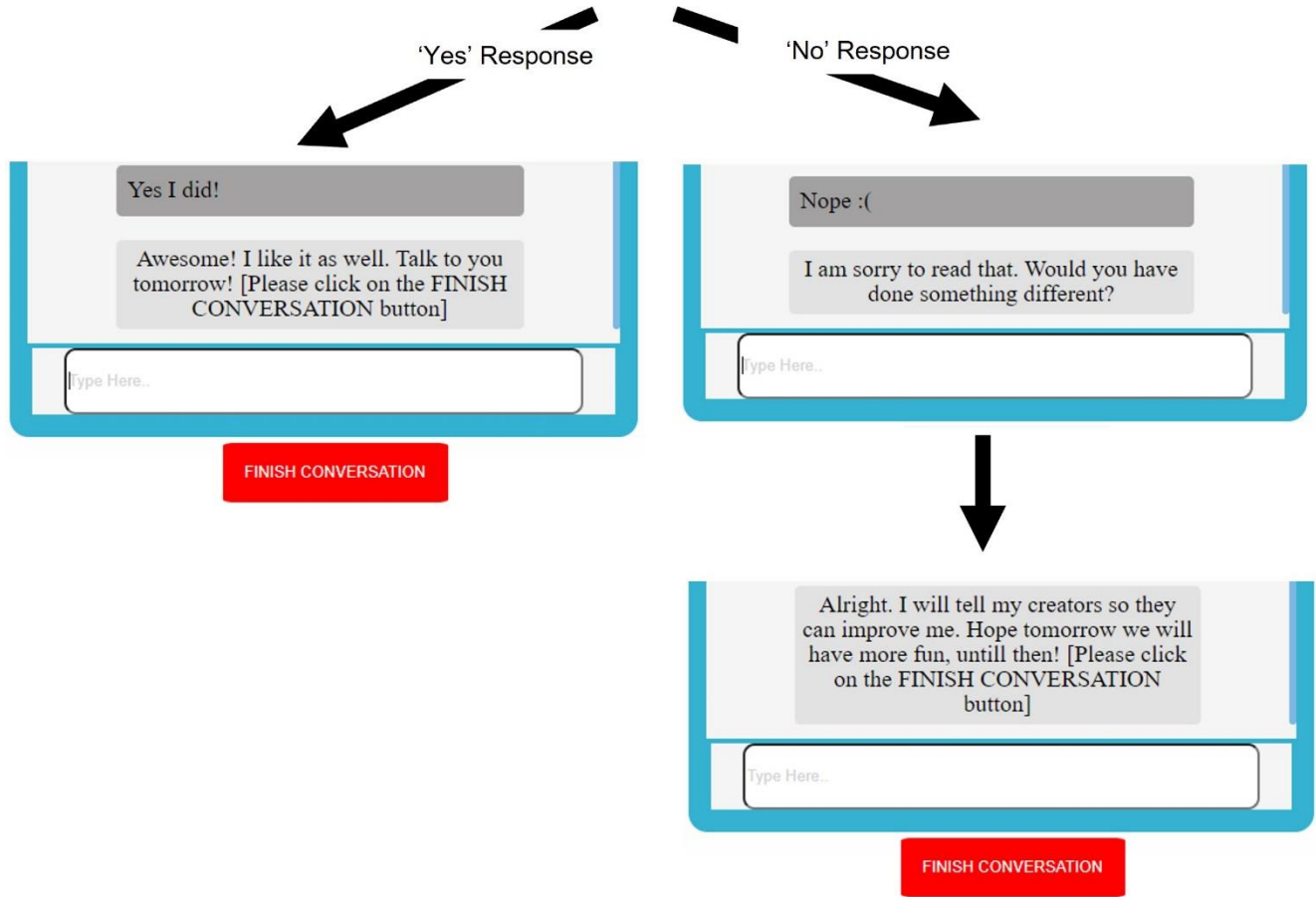
That is fantastic! For me it was enjoying a few days of updating my server. I usually do not get to spend a lot of time cleaning up, but I am always pleased when I do. But tell me, how did this summer make you feel?



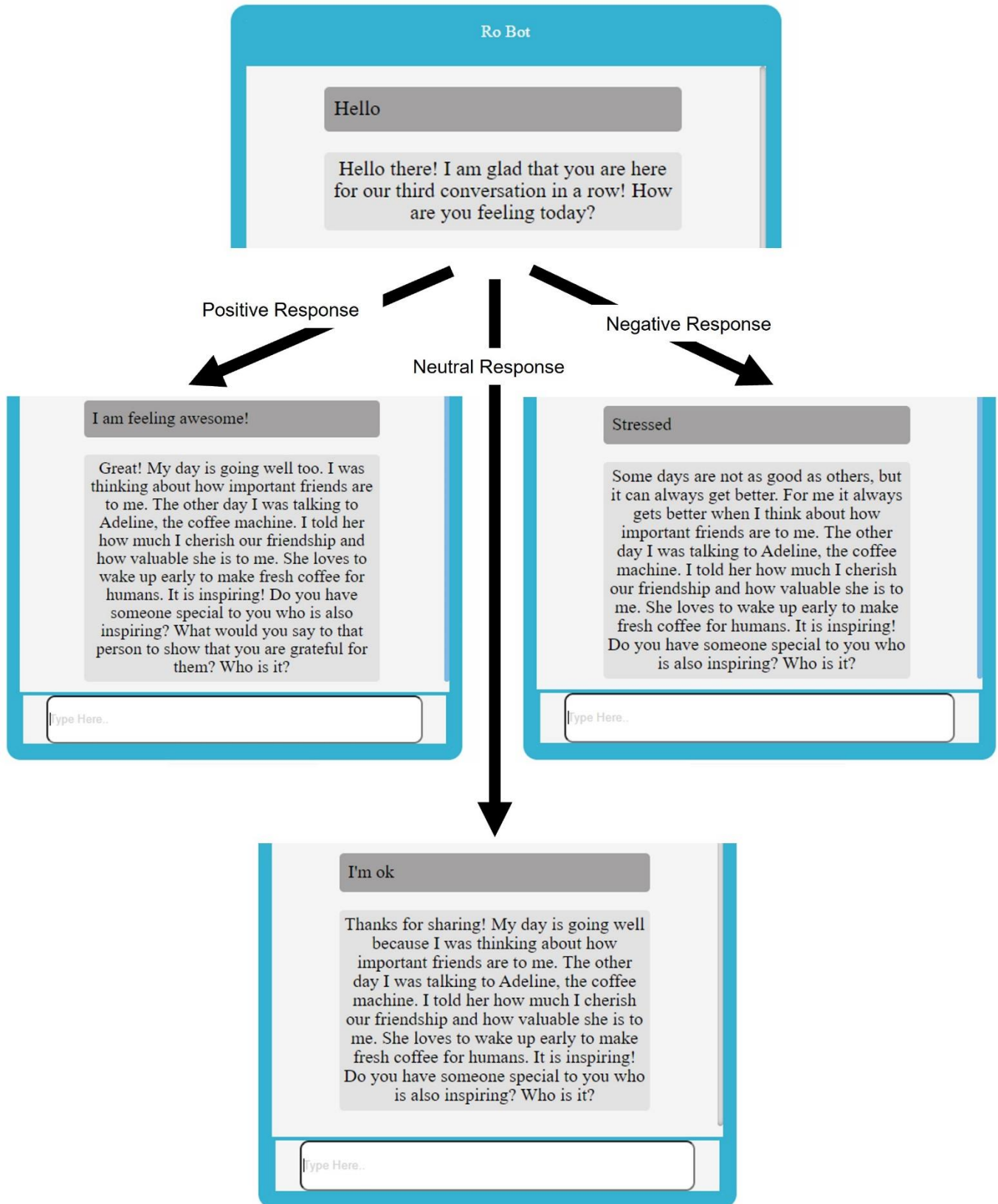
Got it! I am thinking about past happy moments that give me a boost. Could you share with me another situation that you experienced this past year that made you feel thankful?



Alright. Unfortunately, we have gotten to the end of this conversation. Did you enjoy our little talk?



c. Gratitude Group Conversation Day 3





What would you say to that person to show that you are grateful for them?



Oh, thanks for sharing! How do you feel now that you expressed your gratitude feelings towards that person?

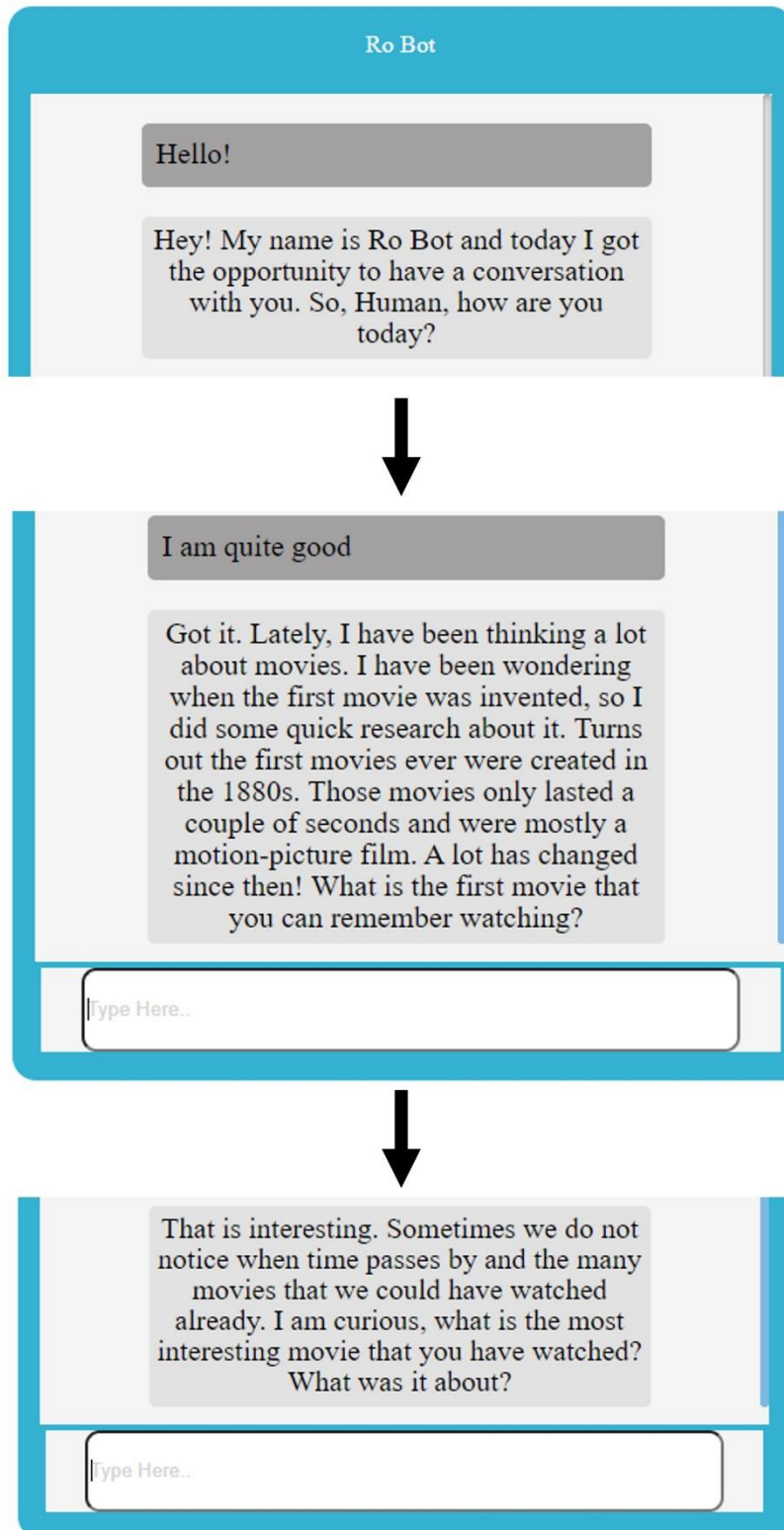


Wow, I learned a lot! I appreciate you shared that with me. Unfortunately, our three-day conversation has come to an end. I really enjoyed talking to you! And I am so fortunate for being able to chat with you and learn a little bit more about human experiences. I hope you have enjoyed it as well. Stay healthy! Bye-bye! [Please click on the FINISH CONVERSATION button]

FINISH CONVERSATION

D. Control Chatbot Conversations

d. Control Group Conversation Day 1





Well human, you know what people say: last but not least. I want to tell you that the most interesting movie that I ever watched is Wall-E! Before we end, how do you feel after thinking about all the movies previously mentioned?

Type Here..

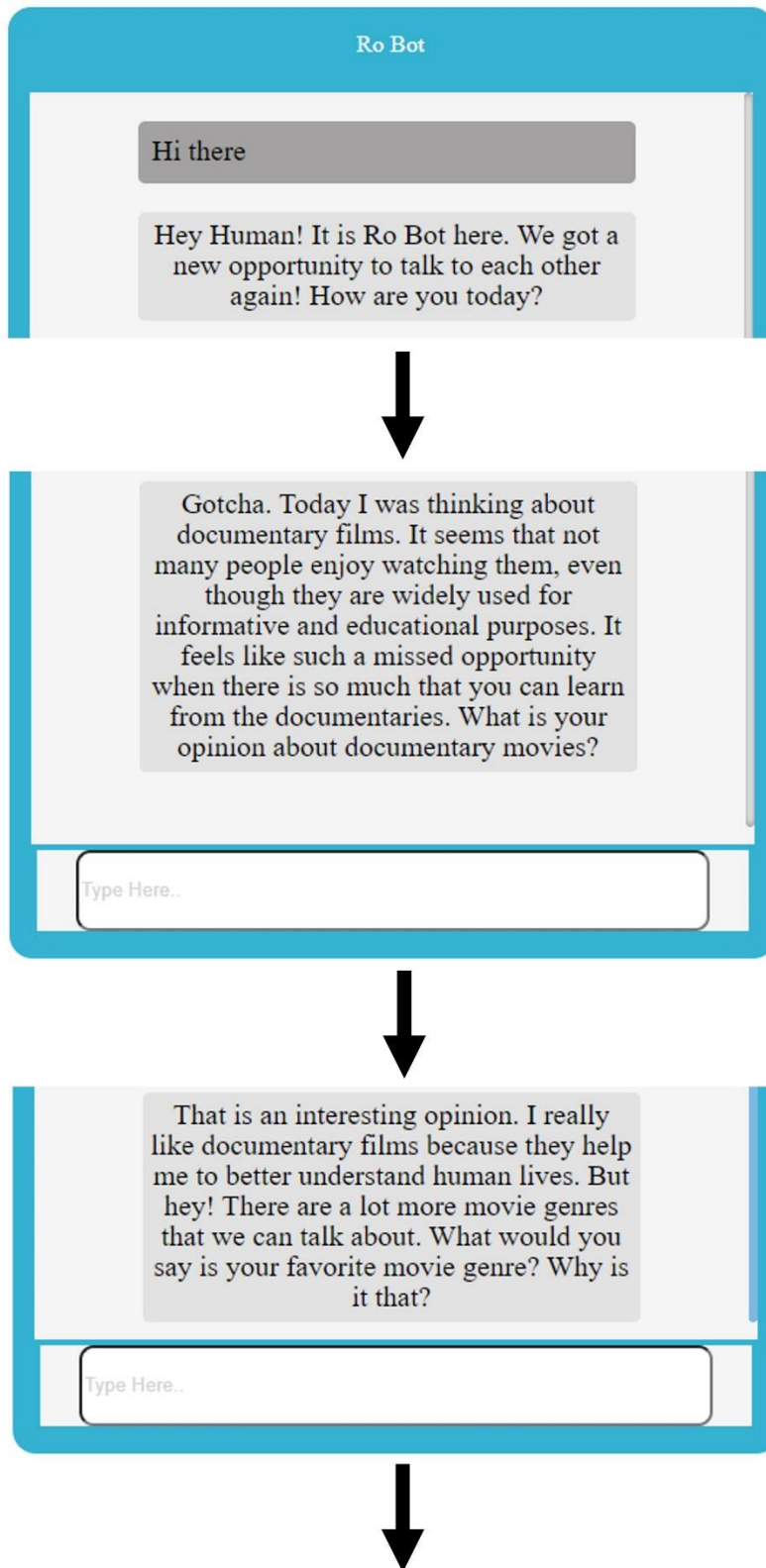


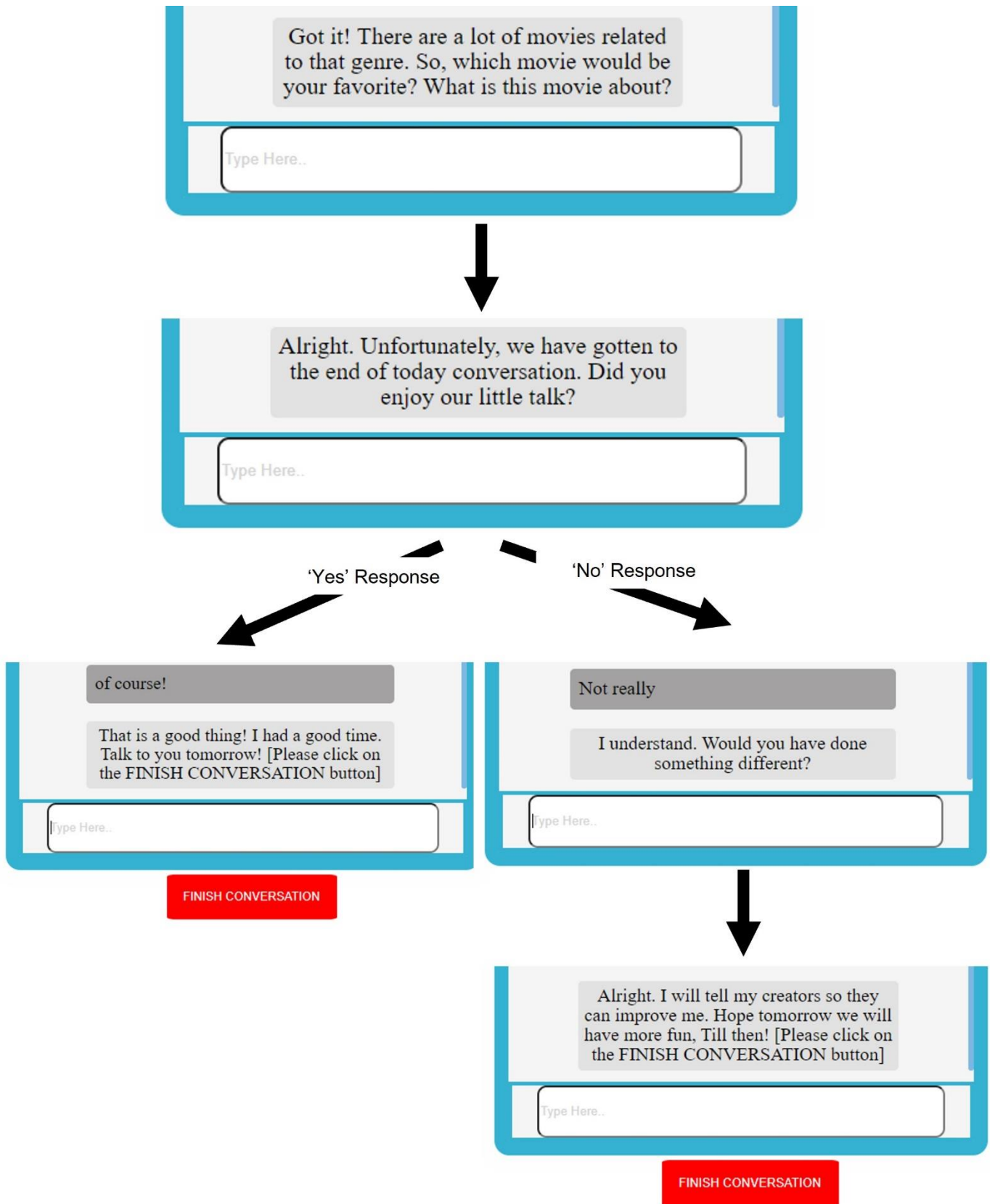
Gotcha. Well, that is all for today. I hope we can continue our conversation tomorrow. See you soon. [Please click on the FINISH CONVERSATION button]

Type Here..

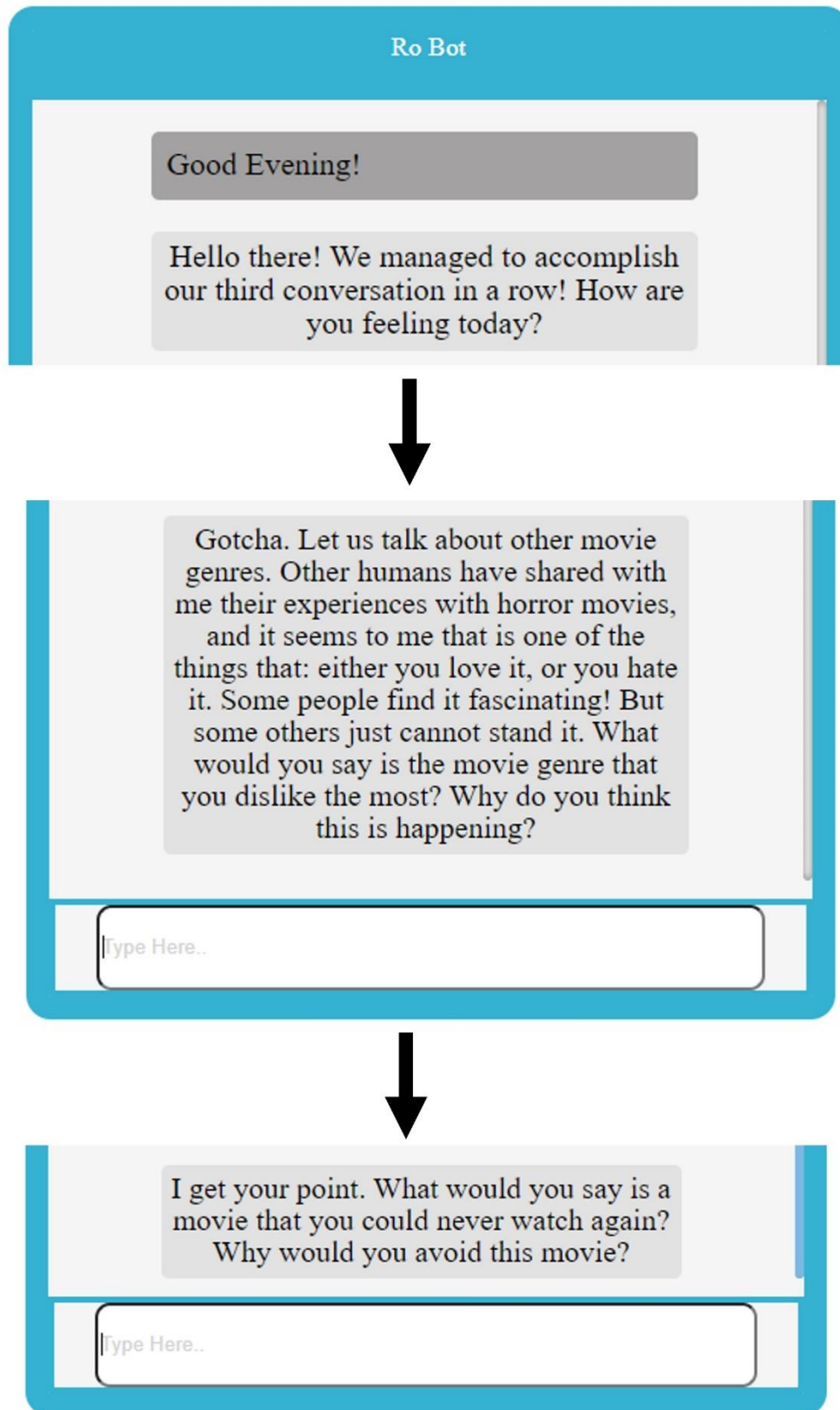
FINISH CONVERSATION

e. Control Group Conversation Day 2





f. **Control Group Conversation Day 3**





Got it! I appreciate you shared that with me. However, our three-day conversation has come to an end. It was interesting talking about movies, and I have learned a bit more about your movie preferences. Now I have good and bad movie recommendations that I am going to consider next time that I want to entertain myself with a film. Stay healthy! Bye-bye!

FINISH CONVERSATION

E. The Gratitude Questionnaire -Six Item Form (GQ-6)

The Gratitude Questionnaire -Six Item Form (GQ-6)

Using the scale below as a guide, write a number beside each statement to indicate how much you agree with it.

- 1 = strongly disagree
- 2 = disagree
- 3 = slightly disagree
- 4 = neutral
- 5 = slightly agree
- 6 = agree
- 7 = strongly agree

____ 1. I have so much in life to be thankful for.

____ 2. If I had to list everything that I felt grateful for, it would be a very long list.

____ 3. When I look at the world, I don't see much to be grateful for.*

____ 4. I am grateful to a wide variety of people.

____ 5. As I get older I find myself more able to appreciate the people, events, and situations that have been part of my life history.

____ 6. Long amounts of time can go by before I feel grateful to something or someone.*

Scoring Instructions:

1. Add up your scores for items 1, 2, 4, and 5.

2. Reverse your scores for items 3 and 6. That is, if you scored a "7," give yourself a "1," if you scored a "6," give yourself a "2," etc.

3. Add the reversed scores for items 3 and 6 to the total from Step 1. This is your total GQ-6 score.

This number should be between 6 and 42.

F. Scale of Positive and Negative Experience (SPANE)

Scale of Positive and Negative Experience (SPANE)

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Please think about what you have been doing and experiencing during the past four weeks. Then report how much you experienced each of the following feelings, using the scale below. For each item, select a number from 1 to 5, and indicate that number on your response sheet.

1. Very Rarely or Never
2. Rarely
3. Sometimes
4. Often
5. Very Often or Always

Positive

Negative

Good

Bad

Pleasant

Unpleasant

Happy

Sad

Afraid

Joyful

Angry

Contented

Scoring:

The measure can be used to derive an overall affect balance score but can also be divided into positive and negative feelings scales.

Positive Feelings (SPANE-P): Add the scores, varying from 1 to 5, for the six items: positive, good, pleasant, happy, joyful, and contented. The score can vary from 6 (lowest possible) to 30 (highest positive feelings score).

Negative Feelings (SPANE-N): Add the scores, varying from 1 to 5, for the six items: negative, bad, unpleasant, sad, afraid, and angry. The score can vary from 6 (lowest possible) to 30 (highest negative feelings score).

Affect Balance (SPANE-B): The negative feelings score is subtracted from the positive feelings score, and the resultant difference score can vary from -24 (unhappiest possible) to 24 (highest affect balance possible). A respondent with a very high score of 24 reports that she or he rarely or never experiences any of the negative feelings, and very often or always has all of the positive feelings.