Emotional chatbots and the elements that reduce the uncanniness*

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Abstract. The uncaninnes of the user while is using chatbots depends on various factors as the artificial intelligence or the emotions expressed during the conversation. With three chatbots designed to have different elements that can affect the comfort of the user and determine a personality, this research checks the hypothesis that the user expectations will affect the uncaninnes felt during the interaction.

Keywords: Chatbot · Human-computer interaction · Affective computing.

1 Introduction

The Uncanny Valley theory [1] determines that as much as an artificial entity comes close to looking like a human, the more comfortable feels the human that observes or interact with them, since we reach a point that the robot is very similar to a human, when the differences are more visible and generate a sense of eeriness and uncanniness.

This effect is experimented commonly when on the TV we see a robot that tries to imitate a human or even the wax figures created to seem like famous actors. Something inside the spectator doesn't seems right and is out of place.

This theory is also very used on art and 3D modeling, as when the characters are very similar to humans but with imperfections the eeriness appears. That's why many human characters on animation are deformed with not very common characteristics.

As this theory is applied to robots similar to humans, it can also be applied to chatbots, being the other side of the coin, as we are not focused on the aspect but on the meaning and interaction with the chatbot. That's why most chatbots don't try to seem humans, to escape from this uncomfortable effect and focus on the user needs. Even so, some developers are starting to create conversational agents that overcome this theory, like 'Geminoid HI-24' [**?**]. This starts a discussion on whether chatbots should or not try to imitate humans.

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2 State of the art

2.1 Scientific panorama

There is no exact knowledge about what is causing this uncaninness effect, but there are different possible origins studied, as it seems the primates near to humans feel this eeriness too facing robots similar to humans, so it could be a basic instinct from a common ancestor to act sociably and manage strange encounters [7]. There are a few ways to reduce this uncanny effect, as make the robots express correctly the emotions, a realist language and a logic and fluid conversation. Being exposed to robots can make the user get used to it and feel comfortable with the interaction [7].

To investigate this phenomenon we should first identify which elements the user identifies when interacting with a chatbot[**?**]:

- The interface: How we interact with the bot and which elements are disposed to interact effectively and pleasant.
- The intelligence: The capacity to answer correctly and proportionate the information requested.
- The integration: In which devices the user reach the chatbot and under which circumstances.

Something in common is the fact that the user facing something that tries to imitate a human has high expectations similar to the ones with another human, and when doesn't receive this expected feedback emotional when the user feels the uncaninness [6]. An example is the research [8], determining that the users that talk with a chatbot with an avatar of a human will feel irritated and upset when the chatbot didn't answered as expected. An important fact about the expectations is the capacity of the bot to answer and maintain a quality conversation at the level of a human, giving and understanding the information necessary [1].

The research [2] show how the users value the interaction and add affinity with the chatbot when it answers satisfactorily, and it's when they get a competent conversation when they positively value the implementation of emotions. So we can say that a good emotion management by the chatbot is useless without the work to make the chatbot understand and process correctly the information.

A problem within the scientific community when providing meaningful information about this topic is that each research is done under some circumstances that are not always taken into account, as the level of the responses of the artificial intelligence or the interaction elements included that affects the perception of the user, leading to similar studies that bring opposite results about the effect of the uncanny valley on chatbots [6].

On this research [3] they tried to use a totally emotionless chatbot and another chatbot with an avatar from a person and sound that expressed emotions. In that case the users felt uncomfortable with the emotional chatbot and preferred the inexpressive one. Curiously, in a similar study [11] the opposite results were reached. They tried to use an emotionless chatbot and other two with avatar

of drawn teenagers expressing emotion within the avatar and the text itself. In that case, the 63% of the participants preferred the emotional chatbots and even recognized the two of them with different attitude and personality.

The perception of the user could be a biased opinion due to their own experiences or expectations. For example, the result is not affected by the level of academy studies, the gender or the place where they live [3], but being into the autistic spectrum increases the effect of the uncanny valley theory, as it's more difficult to them to identify and interact with emotions in general [4].

2.2 Technology and Project Management

The implementation to do the three chatbots for this research, among the many response processor for chatbots, the open source Cakechat Emotional Generative Dialog System [2] was used, implemented inside an AWS t2.medium server with 20 GB of space was used.

This server take POST requests with the last 3 dialogues and an emotion, and it returns a meaningful and emotional response.

The request was implemented inside a HTML page with the use of jQuery to process the request and alternate the interface elements with an Ajax request.

The design of the chatbot is very simple to not distract and is responsive for many devices.

The project started as a Master's final project from the Spanish University UOC (Universitat Oberta de Catalunya) and was implemented by the student and managed with the help of the teachers. It took 4 months to develop and research (from September 2020 to January 2021), taking 3 months between designing and developing the chatbots and the data collect. First 5 chatbots were designed and tested with 5 testers from different groups that had to answer a form but as the information were not understandable or conclusive the final data collect was made by interviewing the participants.

3 Methodology

3.1 Objective

This research tries to prove the hypothesis "User expectations that are not met during chatbot interaction create discomfort" and all the design revolves around this idea. This expectations can come from 3 different angles:

- The interface and description: The chatbots are designed and described to seem something different from the beginning.
- The previously experience with chatbots: If the participant have enough experience with chatbots will be used and expect something more realistic.

– The perception: Autistic people are half of the interviewed as they perceive different the emotions from the neurotypical.

As secondary objective the study tries to understand which elements are creating more uncaninness to the users and which design would be the best for each group.

3.2 Design

The chatbots have a base design that is the same for all of them, designed to look like a regular chatbot adaptable to mobile and computer, but have some elements that differ on various levels to test the limits of the uncaninness and what is more important to the average user.

The elements used on the chatbots that vary in different levels are only three so it can be adjusted and there is no need of several chatbots, being able to focus all the data collection on the most important.

– Avatar: Different levels of realism on the avatar character.
– Time response: The server answer in 3 seconds approximately, but this time can be elongate.
– Voice: The chatbot will reproduce with a robotic voice the text answered to the user. It can have different levels of pitch and velocity.
– Emotions: We send an emotion to the server so the response and the avatar change expressing this emotion. The user can select one of the five emotions on a drop-down for each message sent.

There are three chatbots, so all the elements can be tested in different adjustments. All of them are thought to create a global effect to differ from the user expectation.

– Karen the nice woman:
  • Expectations: The user will expect a nice woman, as the avatar is from a real woman, will expect nice emotions.
  • Avatar: The most realistic, a real woman with an awkward face.
  • Time response: 3 seconds more added with programming, 6 seconds average.
  • Voice: Pitch high and fast.
  • Emotions: Always neuter.
– Chatty the friendly dog:
  • Expectations: The user will expect a friendly dog, as it's a cartoon dog, will expect the personality from a cartoon character.
  • Avatar: A cartoon dog, similar to something known for the user approaching to a human, that changes from the emotions.
  • Time response: 3 seconds average from the server time response.
  • Voice: Changing with the emotion, trying to express the emotion.
  • Emotions: Always random.
– Pumpkin the terrific pumpkin:

- Expectations: The user will expect a terrific character, as the avatar is a Halloween pumpkin dark face, will expect something bad or uncontrolable.
- Avatar: Not even a character, just a pumpkin Halloween face that changes from the emotions.
- Time response: 6 seconds more added with programming, 9 seconds average.
- Voice: Pitch neuter and slow.
- Emotions: Always corresponds to the emotion provided by the user.

3.3 Data Collect

The data will be collected from interviewing the participants just after they interacted with the three chatbots following some instructions so all the experiences are similar.

The groups selected for this research was combining the experience factor and autistic factor, so we have 4 groups to compare between them. Each group has 5 people to have significant and conclusive information.

The information to enter a group is answered before the test, so we determine if they are autistic answering them and we determine if they have experience with chatbots answering how much times they have interacted with a chatbot. If the answer is 5 or more, they enter the group with experience.

Groups:

- Neurotypical without experience
- Neurotypical with experience
- Autistic without experience
- Autistic with experience

The interviews subsequent the interaction will be following some questions to separate the different experiences of the participants and will answer each element from each chatbot individually, with the level of realism and uncanninnes. There will be asked to the user to order the chatbots following their comfort with each chatbot and explain why.

References

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