Advances in Cognitive Systems X (20XX) 1-6 Submitted X/20XX; published X/20XX

Establishing Social Presence with a Voice-Only Chatbot

Abstract

As voice-based chat-bots gain popularity, they challenge to change the way we interact with machines and the Internet. Popular chat-bots like Amazon Alexa are being built with the intention to be intimately integrated into their users' lives and even become a social companion to the user. To achieve this level of involvement in a person's life, a chat-bot must have to establish social presence with the user. Social presence is the experience of interacting with intelligent entities, and is the foundation for establishing trust, providing companionship and creating various entertainment effects. In this paper, we review the design of social bots from the perspective of creating social presence. We also propose a set of behavioral measurements for inferring the user's experience during the interaction.

1. Introduction

In recent years, voice or text-based chat-bots such as Siri and Alexa have gained tremendous popularity. In 2016 alone, hundreds of chat-bots have been published. Many major social media companions such as Facebook and WeChat have supported developing chat-bots on their platforms. Microsoft's CEO Satya Nadella once commented: "Chat-bots are the new apps." Most of these existing chat-bots function as an assistant in the user's daily life by answering questions, reminding them about events in their calendar, helping them make travel arrangements, and even becoming a portal for controlling smart home devices. Chatbots have also been taking up the roles of office assistants. 19% of the 566 IT professionals surveyed by Zakrzewski (2017) said their organizations have already used such agents in streamlining office tasks. More than half people in the same survey believed in the next 3 to 5 years chat-bots will be used in their work related tasks. As the ways of interaction with these chat-bots get closer to the way one interacts with a real human, the role of a chat-bot in its user's life is often speculated. More specifically, whether the chat-bots are treated merely as tools or, do have the potential of becoming a social companion.

The history of chat-bots can be traced back to the 60's when the first chat-bot Eliza was created. Eliza does not perform any task in real life. It tries to talk as a person – more specifically as a psychiatrist – and engage the user in the conversation for as long as possible. Many chat-bots of this kind that pretend to be a person were developed after Eliza e.g. Alice, Mitisuku and Rose. Most of them aimed at engaging the user in human-like conversations. Chat-bots are also closely related to a family of intelligent conversational agents like tutoring agents, video game characters, and digital Bickmore & Rosalind (2005); Segura et al. (2012) or robotic companions Broz et al. (2009); Sabelli et al. (2011).

Giving the user a feeling of talking to a real person or at least an intelligent human-like entity is a common design goal across media forms. This experience is referred to as social presence Heeter (1992); Biocca (1997). It is the foundation for establishing trust and rapport, providing companionship and, reaching various entertainment effects. Most tutoring agents, game characters, and artificial companions have a physical or digital body. Chat-bots such as Siri or Alexa, on the other hand, do not have a body associated with them. In this work, we want to investigate how such voice or text based chat-bots can create the experience of social presence with the user. The fact that communication can only happen through conversation imposes various challenges for creating social presence. In the next sections, we will first review popular chat-bots that appeared in recent years, then present related work on the experience of social presence and discuss how social presence can be realized in voice-based chat-bots. In particular, we argue that managing the user's expectation is the key factor in creating social presence. Finally, we propose a set of dialogue based behavioral measurements for estimating the user's experience of social presence during the interaction.

2. Recent Chat-bots

We have seen a progression towards natural language being used to interact with machines. In this light, many industries and companies have made efforts to make their information available through chat-bots, much like making websites in the 90's. Many general purpose conversational chat-bots have also been developed. This section briefly introduces the popular chat-bots from 2016 and their goals. The chat-bots in Table 1 were picked from winners of chatbot contests such as ChatBottle 2016 Gamanyuk (2016). For preparing the table, we interacted with the chat-bots, and collected additional information from online reviews. The entries marked with * have been reviewed on the basis of demo videos in addition.

We reviewed the chat-bots based on both the form and the content of the interaction. More specifically,

- Visual Type: If the chat-bot has a face that may or may not show emotion;
- Topic Specialized in: The domain expertise of the chat-bot;
- Input Type: How the user interacts with it, e.g. through text or speech;
- Voice Enabled Output: Whether the chat-bot replies through a voice or through text;
- System Control on Dialogue: How much the system controls the dialogue – on a scale of Low-Moderate-Strong;
- Dialogue Richness: How rich the dialogue is – on a scale of Low-Moderate-Strong,

There are no commonly agreed benchmarks for deciding how much system control a chat-bot uses in its dialogue. For consistently labeling them in Table 1, we applied the following criteria. For chat-bots that ask the user to select his/her responses from a list, we consider the system is exercising the highest level of control. A chat-bot with a moderate level of system control will at least allow the user to give his/her own response but may not know how to respond to the user, and may push the user towards answering the original questions. The first two types of chatbots are typically task-oriented domain specific chat-bots, and that's why they need to have high control over the dialogue. A chat-bot with low control on the system dialogues typically are not limited to

having conversations in a specific domain and allow the user to have more freedom in choosing the topics.

For evaluating dialogue richness, we take into account whether the chat-bot tried to be witty while responding to sentences it wasn't trained for, whether it remembered what was said earlier. Most chat-bots do this to a certain extent more than the others and are ranked as moderate. However, from the second-hand review of Xiaoice, we expect that its dialogue would be a lot richer as it can appeal to the emotion of the user on many levels as will be discussed briefly later.

In Table 1, we roughly classify the chat-bots in the spectrum starting from task-oriented to conversational chat-bots. An example of a task-oriented chat-bot is Instalocate which helps the user track an airline. A typical behavior of such a chat-bot is it may choose to not meaningfully respond to sentences uttered by the user which are not directly relevant to its goal. For example, a chat-bot that helps book tickets may not have a good response to "Tell me about the weather in my destination location" and the control of the system on the dialogue is very high to the extent that sometimes user's input has to be selected from a list.

At the other end of the spectrum are conversational chat-bots. The aim of such a chat-bot is not to bring out any specific information to the user or to complete a specific task for them, but more like to fill-in as a conversational partner who tells stories, expresses empathy, etc. It may be a one-domain expert but is mostly a jack-of-all conversation agent. Such a chat-bot may fill in the shoes of e.g. a TV host Brian (2016) or a tour guide Moffat (2016). Such chat-bots do come off as a one-domain expert system - e.g. a tour guide must be an expert in the history of a certain place. Yet, the importance of having a pleasant conversation is higher than simply serving information like telling the user about the weather or booking their tickets. Yeshi, whose goal is to tell a story and evoke empathy from the user towards a social cause, falls in this range eventhough the control of the system over the conversation is higher than other chat-bots that aim to reach the user's feelings. Xiaoice (mee (2014)) takes this to another level as a bot built in messenger systems and behaves like a sympathetic friend Mozur & Paul (2015). A chat-bot like Xiaoice can be considered to be an expert in the person they are talking to, i.e. the domain of this chat-bot is the user's background and life. This is because the chat-bot will store the mood and other personal details of the user, like, significant life events and ups-and-downs of the user. This information may be used it to sound more friendly, involved and empathetic. Such chat-bots typically can engage in a wider range of dialogue compared to the task-oriented ones.

There are many chat-bots that do not specialize in any one specific domain as such and are commonly called voice assistants. Apple's Siri, Microsofts Cortana, Amazon's Alexa and Google's voice assistant are all good at a collection of tasks. They can fetch you the news, set an alarm, remind you to buy groceries or even play music for you amongst other functionalities. These bots are also goal oriented in the sense that their primary goal may not be to fetch information of a specific domain but rather to get a simple task done for the user that, perhaps, could have been accomplished by a few clicks/taps. Fig. 1 shows some of the logos of the popular chatbots discussed.

Table 1: Comparison of Popular Chat-bots

	Visual Input	Topic Specialized in	Input Type	Voice enabled output	Control of System over Dialogue	Dialogue Richness
Instalocate	None	Tracking Flights	Text	None	Moderate	Low
Meekan	None	Scheduling Manager	Text	None	Moderate	Low
Foxsy	None	Matchmaking	Text	None	Strong	Low
BFF Trump	None	Entertainment	Text	None	Strong	Moderate
ChatShopper	None	E-commerce agent	Text	None	Strong	Moderate
TechCrunch	None	News	Text	None	Moderate	Moderate
Talla	None	HR Task Agent	Text	None	Moderate	Moderate
SPIXII	None	Insurance Agent	Text	None	Strong	Moderate
Swelly	None	Social Ratings	Text	None	Strong	Low
Yeshi*	None	Social Initiative	Text	Text and Links		
Siri	None	General Purpose Assistance	Speech	Yes	Low	Moderate
Cortana	None	General Purpose Assistance	Speech	Yes	Low	Moderate
Google Assistant	None	General Purpose Assistance	Speech	Yes	Low	Moderate
Ava (Auto Desk)	None	Tech. Support	Text	None	Moderate	Moderate
Xiaoice*	None	Broad Domain	Multiple	Multiple	Low	High

3. Social Presence

The experience of feeling socially present with an artificial life belongs to a family of experiences associated with being present in a virtual world or a remote location. The sense of "as if being presence" Heeter (1992); Slater et al. (1994) is defined as an illusion of presence typically created by books, movies, computers and other media, and may involve both – physical displays and social characters. Thus, the users may feel being physically present in the virtual environment or socially present with an intelligent character. More specifically, Heeter Heeter (1992) defines the experience of social presence as "the extent to which other beings in the world appear to exist and react to the user". Biocca et al. Biocca (1997) refers social presence as "perceived access to another intelligence (not necessarily a real human)."

Figure 1: Popular Chat-bots of 2016

Many factors contribute to the experience of presence. IJsselsteijn et al. (2000) divided these factors into three categories. The first category is regarding whether the media is causing a distortion or discomfort in communication, and, being able to create the illusion of "non-mediation" Lombard & Ditton (1997). For example, poor image quality or a delay in responding will typically hurt people's experience of presence with the characters. The second category contains factors that describe the properties of the content presented in the virtual environment, both, regarding the physical objects in the virtual environment and the social elements. Typically, richer and more relevant content will result in a higher sense of presence. The third category contains factors regarding the user's past experiences with artificial lives, mental conditions, and expectations. Next, we will review these factors in more details and discuss their relationships with voice or text based chat-bots. In many cases, the experience of social presence cannot be separated from physical presence. However, the type of chat-bots we are discussing in this paper try to become a part of the user's life, and therefore only seek to achieve social presence. In the rest part of this section, we will concentrate more on discussing factors that are related to social presence.

Media Form: Regarding media form related factors, Biocca Biocca et al. (2003) points out that interactivity fosters social presence. Short, Williams and Cristie Short et al. (1976) believe that the saliency of information provided about the virtual character is an important factor for the degree of presence the user experiences. In other words, the bot should provide affordance for social interaction. Human social communication typically contains both verbal and non-verbal components. Verbal communication is realized through language. Non-verbal behaviors include facial expression, gaze, gesture, body posture, etc. For text or voice based chatbots, for realizing the effect of "non-mediation" in their communication, their verbal responses should be fast and clear – readable is text is used and comprehensible is text to speech is used. They should also follow social norms and in particular conversational norms in their dialogue. This overlaps with the

content factors which we will discuss next.

Content Factors: In order for the user to feel present in a virtual environment, the content of the virtual environment needs to be meaningful Hoffman et al. (1998). Predictability, consistency, and plausibility are three commonly desired properties of such virtual environments Slater & Usoh (1993); Held & Durlach (1992); Baños et al. (2000). For virtual environments that have a narrative component, the quality of the narrative also affects the user's sense of presence IJsselsteijn & Riva (2003).

For conducting social interactions, predictability requires the events and results of the user's actions to be within a range that can be anticipated by the user. In other words, for the user to feel present, the user should be able to form a mental model of the virtual world or the virtual character it is interacting with Biocca (1997). It is, therefore, beneficial to clearly define the boundary of the dialogue ahead of time. This is unfortunately usually not trivial because of the nature of social interaction, unless, the chat-bot is only aimed at performing very specific tasks. One technique that may help the user form such a mental model is to provide the chat-bot with consistent and plausible intentions and motivations. Breazeal studied the requirements to "promote the illusion of a socially aware robotic creature" and found that "to socially engage a human, its behavior must address issues of believability such as conveying intentionality, promoting empathy, being expressive, and displaying enough variability to appear unscripted while remaining consistent" Breazeal (2000). Similar arguments have been given for creating digital companions Bickmore & Rosalind (2005), and, for assistant robot. It is found that even though an assistant robot does not need to represent a social character, having a "personality" helps the user to understand and predict its behaviors.

User's Characteristics: "Willing suspension of disbelief" is a concept first used in literature theories. This action/mental process enables the user to feel that the virtual environment or virtual character is real, and therefore is an important factor for the user to experience presence Baños et al. (1999); Steuer (1992). How much the user can tolerate the unrealism is related to the utility of the interaction Wirth et al. (2006). For example, if fully immersing into a digital game is enjoyable, the user would be more willing to believe the virtual environment is real and ignore the imperfection in the simulation. For social bots, whether the content of the dialogue is useful and engaging will affect the user's "willing suspension of disbelief". From the perspective of making the content of the social interaction predictable and consistent, it can be beneficial to restrict the user's interaction with the bot to a well-defined domain. However, this may endanger the user's perception of the bot being an intelligent entity, therefore, lower the user's "willing suspension of disbelief".

There are many other user characteristics that may affect the user's experience of presence, but can not be manipulated by the designer of the chat-bots, such as the user's prior experience of talking with chat-bots, and the user's mental health conditions. These factors will not be discussed in detail here.

3.1 Measuring Presence

The measuring of presence can be classified into two broad categories – subjective measures and objective measures. Subjective measures include questionnaires Vorderer et al. (2004); Lombard et al.

(2000); Harms & Biocca (2004); Short et al. (1976), continuous assessment done by the subject IJsselsteijn et al. (1998), qualitative measures, such as structured interview, and subjective corroborative measures, such as breaks Brogni et al. (2003) in the experience. Objective measures include physiological measures Laarni et al. (2003); Dillon et al. (2003), behavioral measures IJsselsteijn et al. (2000), and task performance measures Slater et al. (1996).

Questionnaires are most commonly used method for measuring presence. Questionnaires are easy to use, do not interfere with the user's interaction, and usually have high face validity and structural validity. A main disadvantage of questionnaires is that they are retrospective and rely on people's memory, which may not accurately reflect their experiences, and is prone to various biases. Questionnaires are not able to track changes in the user experiences either. In contrast, behavioral measurements, though may not be trivial to implement technically, can measure presence continuously and do not depend on memories. Behavioral measurements are common techniques used in studies of face-to-face interactions. The assumption behind the use of behavioral indicators is if the user feels presence in a virtual environment or with a virtual character, he/she will react in the same way as in real life. The commonly used measurements include facial expressions, postural responses, reflect responses, and social responses IJsselsteijn et al. (2000).

When talking to a chat-bot, typically the user is not monitored by a camera, and therefore many traditional behavioral measurements can not be applied. In the next section, we proposed a few dialogue based measurements for inferring the user's experience of social presence with the chat-bot.

4. Proposed Dialogue Based Measurements for Social Presence

The definitions for social presence are very close to the concept of "rapport" in social psychology. In fact, the behavioral measurements of rapport Gratch & Okhmatovskaia (2006) are largely overlapping with behavioral measurements for social presence IJsselsteijn et al. (2000). Therefore, we suggest using several behavioral indicators of good rapport for measuring social presence. We picked these indicators both because they may suggest the user is feeling socially present with the bot, and they can be easily observed and relatively dependably measured.

Interruption and Overlap: When two people are having a conversation, there is a good chance of an overlap between them - that is, both of the people speak at the same time. Such an overlap is short and often shows enthusiasm in conversation and encourages the initial speaker. Gail Jefferson categorizes overlaps into three categories Jefferson (1984):

1. Transitional overlap - This overlap is seen when the first speaker is almost at the end of his idea and the other speaker enthusiastically takes over the conversation.

2. Recognitional overlap - This overlap is seen when the sentences of the first speaker are finished by the second speaker in anticipation of what will be said.

3. Progressional overlap - This overlap is seen when the first speaker is looking for a word and the second speaker fills it in.

With some differences in different cultures, overlaps can mostly be regarded as a positive sign of the user's engagement in the conversation. The absence of this sign, on the other hand, should not be simply interpreted as lacking engagement. When two speakers have good rapport, they often mimic each other's conversational habits. Most chatbots do not interrupt the user, and therefore the user may exhibit the reciprocal behavioral pattern.

Matching the Chatbot's Conversational Habits: As argued by Howard Giles in his Communication Accommodation Theory, people tend to mirror the behavior of the person they are communicating with regarding gestures, vocal patterns, sentence structures, etcTurner & West (2010). A good conversation would potentially lead to convergence between the two individuals. Therefore, certain amounts of convergence are seen as a likable quality in communication.

In the context of a chat-bot that has no face, we eliminate matching gestures being a possible way to achieve convergence. We do concentrate and explain on matching vocal patterns and sentence structures below.

Convergence through a sentence structure can be seen in the example of a question being posed to a person and the way it is answered - they would have a similar sentence structure. For example, consider the following two hypothetical conversations between a restaurant manager and a customer:

Customer: Till what time are you open?
Manager: We are open till 9 p.m

Customer: What time do you close at?
Manager: We close at 9 p.m.

As seen, the manager can choose to inter-change her/his replies in the two examples and, it would still be a valid and coherent communication that follows all rules and practices. However, using a similar sentence structure as the customer i.e. telling the customer about the *closing time* versus telling the customer until what *time they are open* depending on the choice of words of the customer would make a difference. The given examples would be seen positively as the differences between two people tend to reduce due to convergence.

Coherency in Conversation: In a good conversation, the two partners are in the same topic-space most of the time. It is not a good sign if the user attempts to frequently change topics regardless of the chat-bot's intention.

One of the ways to measure the coherency in a conversation was developed by Herring et al. Herring & Kurtz (2006). Their algorithm can measure the semantic distance between two turns of the dialogue. Herring et al. showed the different patterns seen in different stages of conversation such as greeting sequence, topic drift, digression, etc. By analyzing how often we see patterns of digression and topic drift and the average semantic distance, we can have an estimation of how coherent the conversation is.

Active Repairment: Confusions and misunderstandings are common phenomena in human-human conversations. People often actively seek clarification in order to make sure the involved parties are on the same page. When confusions or misunderstandings are detected, people also often engage active repairment and rephrase their sentences.

One often does not ask for clarifications from a person they do not want to converse with or do not consider intelligent enough to explain themselves. Self-repairment by the user, therefore, can be an indication of him/her being interested and acknowledging the chat-bot as an intelligent entity. Work being done in modeling repairment such as Hirst et al. (1994) has shine lights in detecting repairment in conversations automatically.

5. Conclusion and Future Work

With the fast development of computer technologies in recent years, chat-bots have become more and more integrated into people's daily lives, as a tutor, a companion, or an assistant. Giving the user a feeling of interacting with a real person or at least an intelligent human-like entity is a common design goal across most chat-bots. In this paper, we review the current developments of chat-bots and their potentials for realizing social presence with the user. We analyzed three categories of factors that contribute to a person's experience of social presence – the media factors, the content factors and the user's factors and, suggested design guidelines for chat-bots. In particular, we argue that the user's expectation is the key factor in determining his/her experience of presence with the chatbot and it is important to design the chat-bot with consistent and meaningful intentions. Since, typically, the user is not monitored by visual or physio sensing devices, we have suggested a set of behavioral observations based on social rapport for measuring whether the user experiences social presence with the chat-bot. These observations include interruptions and overlaps, matching conversational habits, coherence in conversation and active repairment.

In our future work, we will investigate how well the dialogue based measurements we proposed can measure social presences when compared to other (camera or physio-based) behavioral measurements, and established questionnaires. Moreover, depending on the form and the purposes of the interaction, e.g. talking to Siri vs. talking to a chat-bot that acts as a game character, the experience of social presence can be quite different. As part of our future work, we want to conduct both theoretical discussions and empirical studies for distinguishing these experience, and finding out how various factors affect these experiences.

References

(2014). Meet xiaoice, cortana. From `https://blogs.bing.com/search/2014/09/05/meet-xiaoice-cortanas-little-sister/`.

Baños, R. M., Botella, C., Garcia-Palacios, A., Villa, H., Perpina, C., & Alcaniz, M. (2000). Presence and reality judgment in virtual environments: A unitary construct? *CyberPsychology and Behavior*, *3*, 327–335.

Baños, R. M., Botella, C., & Perpiñá, C. (1999). Virtual reality and psychopathology. *Cyberpsychology & Behavior*, *2*, 283–292.

Bickmore, T., & Rosalind, J. (2005). Establishing and maintaining long-term human-computer relationships. *ACM Transactions on Computer-Human Interaction (TOCHI)*, *12*, 293–327.

Biocca, F. (1997). The Cyborg's Dilemma: Progressive Embodiment in Virtual Environments. *Journal of Computer-Mediated Communication*, *3*.

Biocca, F., Harms, C., & Burgoon, J. K. (2003). Toward a More Robust Theory and Measure of Social Presence: Review and Suggested Criteria. *Presence: Teleoperators and Virtual Environments*, *12*, 456–480.

Breazeal, C. (2000). *Sociable machines: Expressive social exchange between humans and robots*. Doctoral dissertation, Massachusetts Institute of Technology.

Brian, M. (2016). Microsoft's xiaoice ai becomes the first live tv weather host. From `https://www.engadget.com/2015/12/29/microsoft-xiaoice-ai-china-weather-host/`.

Brogni, A., Slater, M., & Steed, A. (2003). More Breaks Less Presence. *Presence 2003: The 6th Annual International Workshop on Presence.*.

Broz, F., Kose-Bagci, H., Nehaniv, C. L., & Dautenhahn, K. (2009). Learning behavior for a social interaction game with a childlike humanoid robot. *Social Learning in Interactive Scenarios Workshop, Humanoids*.

Dillon, C., Keogh, E., Freeman, J., & Davidoff, J. (2003). Aroused and immersed: The psychophysiology of presence. *the 3rd International Workshop on Presence.*. Eindhoven, The Netherlands.

Gamanyuk, A. (2016). The 7 best chatbots of 2016, by popular vote. From `http://venturebeat.com/2017/01/25/the-7-best-chatbots-of-2016-by-popular-vote/`.

Gratch, J., & Okhmatovskaia, A. (2006). Virtual Rapport. *IVA*. Marina del Rey, CA.

Harms, C., & Biocca, F. (2004). Internal Consistency and Reliability of the Networked Minds Social Presence Measure. *Seventh Annual International Workshop: Presence 2004*. Valencia: Universidad Politecnica de Valencia.

Heeter, C. (1992). Being There: The Subjective Experience of Presence. *Presence: Teleoperations and Virtual Environments*, *1*, 262–271.

Held, R. M., & Durlach, N. I. (1992). Telepresence. *Presence: Teleoperators and Virtual Environments*, *1*, 109–112.

Herring, S. C., & Kurtz, A. J. (2006). Visualizing dynamic topic analysis. *Proceedings of CHI\'06*. ACM Press.

Hirst, G., McRoy, S., Heeman, P., Edmonds, P., & Horton, D. (1994). Repairing conversational misunderstandings and non-understandings. *Speech communication*, *15*, 213–229.

Hoffman, H. G., Prothero, J. D., Wells, M. J., & Groen, J. (1998). Virtual chess: The role of meaning in the sensation of presence. *International Journal of Human-Computer Interaction*, *10*, 251–263.

IJsselsteijn, W., & Riva, G. (2003). Being There: The experience of presence in mediated environments. In G. Riva, F. Davide, & W. IJsselsteijn (Eds.), *Being there: Concepts, effects and measurements of user presence in synthetic environments*, chapter 1. Ios Press, Amsterdam, The Netherlands.

IJsselsteijn, W. A., de Ridder, H., Freeman, J., & Avons, S. (2000). Presence: Concept, determinants and measurement. *SPIE, Human Vision and Electronic Imaging V*.

IJsselsteijn, W. A., de Ridder, H., Hamberg, R., Bouwhuis, D., & Freeman, J. (1998). Perceived depth and the feeling of presence in 3DTV. *Displays*, *18*, 207–214.

Jefferson, G. (1984). Notes on some orderlinesses of overlap onset. In V. DâĂŹUrso (Ed.), *Discourse analysis and natural rhetoric*, 11âĂŞ38. Padua: Cleup.

Laarni, J., Ravaja, N., & Saari, T. (2003). Using eye tracking and psychophysiological methods to study spatial presence. *the 6th International Workshop on Presence.*. Aalborg, Denmark.

Lombard, M., & Ditton, T. (1997). At the heart of it all: The concept of presence. *Journal of Computer Mediated-Communication*, *3*.

Lombard, M., Ditton, T. B., Crane, D., Davis, B., Gil-Egui, G., Horvath, K., & et al. (2000). Measuring presence: A literature-based approach to the development of a standardized paper-and-pencil instrument. *the Third International Workshop on Presence.*. Eindhoven University of Technology, Eindhoven, The Netherlandss.

Moffat, N. (2016). World-first chatbot tour guide for the new maroochy cbd. From `https://www.sunshinecoastdaily.com.au/news/world-first-chatbot-tour-guide-for-the-new-marooch/3100746/`.

Mozur, J. M., & Paul (2015). For sympathetic ear, more chinese turn to smartphone program. From `https://www.nytimes.com/2015/08/04/science/for-sympathetic-ear-more-chinese-turn-to-smartphone-program.html`.

Sabelli, A. M., Kanda, T., & Hagita, N. (2011). A conversational robot in an elderly care center: An ethnographic study. *Proceedings of the 6th International Conference on Human-robot Interaction* (pp. 37–44). New York, NY, USA: ACM. From `http://doi.acm.org/10.1145/1957656.1957669`.

Segura, E. M., Kriegel, M., Aylett, R., Deshmukh, A. A., & Cramer, H. S. M. (2012). How do you like me in this: User embodiment preferences for companion agents. *IVA* (pp. 112–125).

Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications.*. Toronto, ON: Wiley.

Slater, M., Linakis, V., Usoh, M., & Kooper, R. (1996). Immersion, presence, and performance in virtual environments: An experiment with tri-dimensional chess. *ACM Virtual Reality Software and Technology* (pp. 163–172).

Slater, M., & Usoh, M. (1993). Representation systems, perceptual position, and presence in immersive virtual environments. *Presence: Teleoperators and Virtual Environments*, *2*, 221–233.

Slater, M., Usoh, M., & Steed, A. (1994). Depth of presence in virtual environments. *Presence: Teleoperators and Virtual Environments*, *3*, 130–144.

Steuer, J. (1992). Defining Virtual Reality: Dimensions Determining Telepresence. *Journal of Communication*, *42(4)*, 72–93.

Turner, L. H., & West, R. (2010). Communication accommodation theory. *Introducing communication theory: Analysis and application*, *4*.

Vorderer, P., Wirth, W., Gouveia, F. R., Biocca, F., Saari, T., Jäncke, F., & Böcking, S. (2004). *MEC Spatial Presence Questionnaire (MECSPQ): Short Documentation and Instructions for Application.*. Technical report, European Community, Project Presence: MEC (IST-2001-37661).

Wirth, W., et al. (2006). A process model of the formation of spatial presence experiences. *Media Psychology.*, *in press*.

Zakrzewski, C. (2017). Alexa and cortana may be heading to the office. From `https://www.wsj.com/articles/alexa-and-cortana-may-be-heading-to-the-office-1489372004?utm_content=buffer6f28a&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer`.